

ATMOSPHERIC
OBSERVATIONS
U. S. ARCTIC STEAMER
JEANETTE.
1879-81.



1879 *Dr. J. M. C.*
1879 *Dr. J. M. C.*

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c., graduated into tenths.

Glass ad.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pentekofor's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z.

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

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1879



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Atmospheric observations
on board
U.S. Arctic Steamer
Jeanette
1879 - 81.

Dr. James M. M. Ambler, U.S.N.

Atmospheric Observations on board U. S. S. *Arctic*

SPAR DECK.

BERTH DECK

PLACE.	DATE.	10 A. M.				4 P. M.				10 P. M.				10 A. M.			
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.
Jamalukha	1 30.05 61° 10° 10° 10. 30.17	60° 12° 11° 88°	30.15° 49° 8° 8°	100° 18° 8° 22°													
"	2 30.19 55° 8° 8° 10. 30.31	62° 12° 11° 88°	30.30° 60° 13° 13°	100° 16° 14° 18°													
"	3 30.21 60° 13° 11° 77. 30.27	62° 12° 11° 87°	30.28° 63° 12° 12°	100° 22° 17° 19°													
"	4 30.26 66° 22° 18° 66. 30.26	70° 22° 18° 60°	30.23° 68° 21° 18°	73° 25° 20° 61°													
"	5 30.08 66° 18° 15° 71. 29.93	67° 15° 14° 89°	29.90° 69° 10° 9°	86° 23° 19° 66°													
At sea	6 30.11 62 8° 8° 10. 30.00	69° 8° 7° 86°	30.02° 56° 7° 7°	100° 16° 14° 18°													
" "	7 29.80 59° 7° 7° 10. 29.72	65° 8° 7° 84°	29.78° 49° 8° 8°	100° 17° 15° 63°													
" "	8 29.50 50.5° 8° 8° 10. 29.41	48° 7° 6° 85°	29.37° 44° 6° 6°	100° 18° 16° 71. 14°													
" "	9 29.53 47.8° 6.5° 6.5° 10. 29.63	49° 6° 6° 10°	29.68° 44° 6° 6°	100° 16° 12° 59°													
" "	10 29.73 43° 5.5° 5.6° 10. 29.74	44.2° 6° 6° 100°	29.73° 48° 6° 6°	100° 13° 11° 77°													
" "	11 29.78 43° 6° 6° 10. 29.73	50° 9° 9° 100°	29.74° 43° 8° 8°	100° 18° 16° 90°													
Chichagof	12 29.75 58° 12° 10° 76. 29.75	52.5° 11.5° 10.5° 100°	29.75° 52° 11° 10°	87° 18° 16° 80°													
" "	13 29.82 52° 10° 10° 100. 29.83	56° 12° 11° 88°	29.88° 54° 11° 11°	100° 17° 13° 61°													
" "	14 29.92 63.5° 14° 12° 78. 29.78	56.7° 12° 11° 88°	29.73° 56.5° 11° 10°	87° 22° 17° 58°													
" "	15 29.61 56° 13° 11° 77. 29.52	54° 11° 9° 75°	29.45° 51° 10° 9°	86° 19° 17° 86°													
" "	16 29.31 51.5° 10° 9° 86. 29.42	41° 10° 9° 86°	29.42° 41° 10° 9°	86° 18° 15° 71°													
" "	17 29.54 56° 14° 11° 67. 29.63	56.8° 12° 10° 76°	29.68° 52° 11° 10°	87° 20° 17° 74°													
" "	18 29.85 51° 10° 9° 86. 29.93	53.5° 10° 9° 86°	29.96° 52° 10° 8°	74° 17° 11° 43°													
" "	19 30.04 51° 9° 7° 73. 30.07	57° 11° 8° 63°	30.09° 51° 11° 8°	68° 13° 11° 77°													
" "	20 30.21 50° 10° 8° 74. 30.25	51° 9° 8° 86°	30.30° 51.5° 10° 8°	74° 18° 13° 53°													
" "	21 30.35 57.5° 13° 11° 77. 30.33	57° 16° 12° 59°	30.36° 54° 12° 11°	88. 19° 14° 70°													
At sea	22 30.18 55° 12° 10° 76. 30.10	57° 12° 9° 65°	30.01° 50° 9° 8°	86° 19° 13° 26°													
" "	23 30.03 43° 5° 4° 84. 30.08	40° 4° 3° 83°	30.11° 38° 3° 2°	83° 14° 13°													
" "	24 30.12 39° 3° 2° 83. 30.12	38.5° 3° 2° 83°	30.12° 38° 4° 3°	83° 13° 11° 77°													
St. Lawrence Bay	25 30.18 42° 6° 5° 85. 30.15	42° 8° 5° 59°	30.14° 43° 4° 3°	83° 19° 13° 26°													
" "	26 30.09 43.5° 5° 4° 84. 30.06	49.5° 9° 6° 61°	30.05° 45° 6° 5°	85° 11° 8° 63°													
At sea	27 30.01 52° 11° 8° 63. 30.03	64° 8° 7° 28°	30.02° 42° 4° 3°	83° 15° 13° 78°													
" "	28 30.01 42° 4° 3° 83. 30.00	37° 2° 2° 100°	29.99° 36.5° 2° 1°	82° 7° 5° 71°													
" "	29 29.94 37° 2° 2° 100. 29.93	35.8° 1.4° 1.2° 100°	29.93° 37° 1.5° 1°	100° 19° 8° 63°													
" "	30 29.89 37.5° 2.5° 2° 100. 29.91	38.5° 3.2° 3° 100°	29.97° 37° 2° 1.5°	82° 12° 8° 54°													
	31 30.11 38.5° 2° 1° 82. 30.17	37.2° 3° 2° 83°	30.24° 38° 1° 5°	11° 9° 65° 15°													

AVERAGE -----

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in column.

for the month of August, 1877.

TIME DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.					REMARKS.
	10 A. M.	10 P. M.	NO.	WIND.	WEATHER.	
8 66 10 18 69	calm	Foggy	0			Open deck wet.
11 19 16 71	N.N.W.	Foggy	0			" "
72 19 18 68	calm	Foggy	0			Open deck dry. Bunk deck wet.
51 22 19 60	N.W.	Clear	0			Dry.
62 16 12 59	W	Cloudy	0			Web.
8 68	W/N	Rain				Web.
76 14 13 94	S.N.E.	Windy	1			Wet.
67 11 9 75	N.W.	Windy	1			Bunk deck dry.
3 69	N.N.W.	O.C.	0			Wet. "
11 6 90	N.W/N	O.C.	0			Wet. "
8 73 15 13 78	N.W/N	O.C.	0			Web. "
11 67	N	Clear	1			Wet. "
63 17 17 48	N.N.E.	O.C.	2			Web. "
22 19 17 81	N.N.E.	O.C.	2			Wet. "
5 80 15 12 68	N	O.C.	2			Web. "
5/2 0C			2			" "
10 49 14 12 28	Clear	O.C.	1			" "
58 18 9 55	N.W.	Clear	1			Dry. "
11 12 14 10 57	N.N.E.	O.C.	0			" "
13 63 13 10 66	N.W.	O.C.	0			" "
15 29 14 12 78	Clear	O.C.	0			" "
11 67 14 11 67	..	O.C.				Open deck wet from taking in water on side.
89 14 13 89	N.W.	O.C.	0			" "
9 61	N	Clear	0			Web.
66 12 9 66	Clear	O.C.	1			Wet.
10 57	N	Clear	1			Wet.
6 50	N.E.	O.C.	1			Wet. Bunk deck wet. Ship not a sea
10 76	N.W/N	O.C.	2			" "
80 14 11 47	W/N	O.C.	2			Bunk deck dry
68 11 8 68	N	O.C.	2			" "

in the morning should be selected. The results will not be entered unless the observer is certain of their accuracy.
entered in column of Remarks.

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The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Arctic Star Jan 1871

Atmospheric Observations on board U. S. S.

PLACE.	DATE.	SPAR DECK.						BETH DECK.											
		10 A. M.			4 P. M.			10 P. M.			10 A. M.								
Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Dry bulb.	Relative humidity.	Dry bulb.	Relative humidity.	
At sea	1 30.17 37.5° 1.5° 1°	30.15 34° 0.8° 0.5°	95	30.11 33° 0.2° -5°	87	12° 10° 57° 14°	67° 1												
69° 10' - 176° 6'	2 30.00 39° 1° 0°	29.97 39.4° 3.6° 2.5°	81.5	29.97 37° 1.5° 1.5°	91	15° 18° 48° 21°	55° 1												
70° 33' - 174° 35'	3 30.08 32.5° -1° -1°	30.09 31° -2.5° -3°	89	30.14 33.2° -2° -2°	100	12° 10° 76° 14°	83° 1												
At sea	4 30.15 36.5° -0.5° -0.8°	30.09 36.5° 0.28° 0°	83	30.09 32° 0° -0.56°	14° 13° 89° 9°	80° 1													
off	5 30.05 32° -1.1° -5°	30.03 32.5° -1.4° -1.7°	80	30.03 36° -4° -4.17°	13.5° 12° 83° 17°	70° 1													
Harvest Islands	6 30.03 37° -2.78° -1.9°	30.06 33° 0.56° 0.56°	80	30.07 29.8° -3.33° -2.78°	16.5° 14° 74° 16°	74° 1													
"	7 30.14 30.5° -2.78° -2.78°	30.21 50.5° -2.50° -2.78°	80	30.19 24.5° -4.67° -6.67°	15° 12.5° 94° 15°	65° 1													
"	8 30.17 31.5° -3.89° -3.87°	30.15 36° -2.50° -2.50°	80	30.14 29.5° -3.89° -3.89°	15° 12° 58° 15°	80° 1													
"	9 30.11 32° -3.89° -3.89°	30.17 58° -3.83° -3.61°	80	30.04 24° -6.11° -6.11°	16° 18° 69° 18.5°	58° 1													
"	10 30.10 26° -5.56° -5.56°	29.95° 29° -4.17° -4.33°	80	29.90 21.5° -3.89° -3.89°	14° 11.5° 72.5° 14°	78° 1													
"	11 29.82 39.5° -0.56° -0.83°	29.83 40° 0.00° -0.28°	80	29.82 33° -0.56° -0.56°	16.5° 13° 74° 19.3°	52° 1													
"	12 29.84 33.5° 2.22° -2.50°	29.83 33.5° -1.11° -1.56°	80	29.80 29.5° -3.89° -3.84°	15° 12.5° 72° 15°	78° 1													
"	13 29.79 37° 0.00° -0.39°	29.83 33.5° -0.56° -0.83°	80	29.83 34° -1.89° -1.89°	14° 13° 89° 12°	75° 1													
"	14 29.84 36° -6.83° -1.11°	29.73 34° -0.93° -1.00°	80	29.70 32° -2.22° -2.22°	14° 12° 78° 16.5°	74° 1													
"	15 29.66 29.5° -1.67° -1.94°	29.63 33° -0.56° -0.67°	80	29.67 30° -2.22° -2.22°	13° 10° 64° 12°	76° 1													
"	16 29.76 28° -3.61° -3.89°	29.80 30.6° -1.50° -1.93°	80	29.83 30° -1.67° -1.67°	11.2° 9° 72° 16°	71° 1													
"	17 29.95 30° -3.33° -3.61°	30.07 55° -0.83° -1.11°	80	29.95 34° -0.28° -1.11°	14° 12° 78° 14°	67° 1													
At sea in Park	18 29.96 36° -4.44° -4.44°	29.76 36° 1.67° -1.28°	80	29.73 35° 1.11° 1.00°	18° 15° 71° 18°	85° 1													
"	19 29.67 36° 1.67° 1.39°	29.66 36° 1.67° 1.56°	80	29.65° 32° 0.56° 0.56°	19° 16° 72° 18.5°	55° 1													
"	20 29.61 37° 2.11° 1.94°	29.67 34.8° 0.82° 0.72°	80	29.84 31.5° -1.11° -1.11°	15.5° 12.5° 77° 14.5°	78° 1													
"	21 29.98 34° -0.94° -0.56°	30.05° 33° 0.00° 0.00°	80	30.09 31° -1.67° -1.67°	10° 8° 74° 9°	78° 1													
"	22 30.17 27° -3.61° -3.89°	30.18 30.2° -2.56° -2.94°	80	30.17 22° -5.94° -6.11°	12° 9.5° 71° 10.5°	75° 1													
"	23 29.18 36.5° -4.44° -4.44°	30.10 26.2° -4.44° -5.00°	80	30.12 24.5° -6.11° -6.11°	7° 5.5° 78° 12.5°	45° 1													
"	24 30.09 22° -6.67° -6.67°	30.07 24.4° -5.22° -5.56°	80	30.06 23° -6.11° -6.11°	11° 9° 75° 13°	66° 1													
"	25 29.84 28° -5.56° -3.83°	29.75 30° -8.33° -8.33°	80	29.45 5.4° -8.33° -8.33°	11° 8.5° 69° 10.5°	71° 1													
"	26 29.25° 54° -7.57° -7.78°	29.38 53° -11.94° -11.94°	80	29.42 54° -11.11° -11.11°	9° 6.5° 67° 6°	70° 1													
"	27 29.41 48.5° -12.22° -12.22°	29.42 44° -12.22° -12.22°	80	29.42 44° -11.94° -11.94°	15.5° 3 6.9° 12.5°	62° 1													
"	28 29.40 38° -11.11° -11.11°	29.46 54° -9.44° -9.44°	80	29.51 38° -11.11° -11.11°	8.5° 5.5° 59.7° 8°	72° 1													
"	29 29.66 50° -10.94° -10.94°	29.70 52° -11.39° -11.39°	80	29.68 56° -13.33° -13.13°	10° 8° 73° 7.5°	75° 1													
"	30 27.70 50° -10.38° -10.00°	29.67 57° -10.56° -10.00°	80	29.65 50° -12.22° -12.22°	9° 6.5° 67° 12°	65° 11													
	31																		
AVERAGE		29.86 38.4° -2.1°		29.87 41.2° -2.9°		29.86 30.6° -4.1°													

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning of the 28th. Same instruments to be used in all hygrometric observations.

* 10 P.M. of the 28th. Aneroid removed into the cabin & connected by mercurial tube.

Graeter

, for the month of September, 1879.

ECK.	AVERAGE NUMBER OF SHIP'S COMPANY.					REMARKS.		
	10 P. M.	No.	WIND.	WEATHER.	Relative humidity.			
	Dry bulb.	Wet bulb.	Relative humidity.	Relative humidity.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.		
57	67	14	9	47	NW/n	0°C	2 Open deck wet. Middle deck dry.	
48	45	14	10	57	S/E	Clear	1 Open deck wet.	
76	83	14	12½	93	S E	Thick fog	1	
89	80	19	19	96	Cloud	"	1	
83	70	15	13	78	N	0°C	1	
74	74	16	14½	88	S	fog	1 Ice on open decks	
94	68	12	13	61	S/E	0°C	1	
58	100	18	16	80	NW/S	S E	1	
69	88	12½	14	66	N E	0°C	1	
72	78	15	12	68	N E	0 f	1	
75	15	2	13	74	E	0 f	1	
72	78	12	12	78	S	0°C	0	
49	75	14	12½	78	fog	"	0	
74	74	18	16½	70	S E	0°C	0	
64	126	15	12½	73	S E	0°C	0	
74	81	17	14	70	S E	0°C	0	
78	67	15	13	78	calm	0°C	0	
71	85	17	15	80	S/W	0°C	0.23246 ^{moist} wet from melting air taken at 10 P.M. at the height of observer's deck level of open deck -	
72	85	17	14½	75	S/E	0°C	0.23246 ^{moist}	
57	77	8	11	9	75	S	0	
74	8	14	11½	72	S/E	0°C	0 Ice on deck.	
71	85	11	9	75	SSW	0°C	0	
58	78	16	13	69	S W	0°C, 8mm 4.80120	0	
7	75	4	12½	10	71	SSW	0°C	0 Snow on deck.
35	67	17	13	11	77	calm	0	
0	95	7	67	5	S/W	0°C	0	
66	67	7	67	5	S/W	0°C	0	
2	9.3	7.3	7.1	6.8	S/W	0°C	0	
3	2.8	6	7.2	6.8	calm	0°C	0	
5.6	5.9	6.5	10	7.5	S/E	0°C	0	
8	74	5	11	9	75	S E	0	
65	67	7	67	5	S/W	0°C	0	
0	10.9	11.6	73.1	9.9	0.0.14	2.6206	0 Open deck wet. B dry	
10.9	7.8	14	14	82	0.0.14	2.6206	0	

should be selected. The results will not be entered unless the observer is certain of their accuracy.

line of Remarks.

endure to 32 degrees F

J. M. Amble
Surgeon, U. S. N.

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Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

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Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in millgrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. : : capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Arctic No. 11

Atmospheric Observations on board U. S. S. *Arctic*

PLACE.	DATE.	SPAR DECK.						BERTH DECK.								
		10 A. M.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	4 P. M.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	10 P. M.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.
Bent in Park	1 29.56	7.78-7.78	29.51	9.44	9.44	29.45	10.00-10.01	13	8.5	5.0	7	57				
" " "	2 29.44	-7.82-7.72	29.42	7.34	7.39	29.41	-3.33-3.33	9	6	6.1	14	61				
" " "	3 29.77	-5.08-5.00	29.85	-1.44	-1.44	29.71	-6.11-6.11	8	5.5	6.5	10	74				
" " "	4 29.90	-5.10-5.11	29.92	-5.56	-5.56	29.94	-6.11-6.11	11	8.5	6.9	13	71.5				
" " "	5 29.95	-8.53-8.32	29.96	-9.33	-9.33	29.94	-10.00-10.00	11	9	7.5	11	75				
" " "	6 29.84	-8.06-8.06	29.75	7.53	7.53	29.60	-13.33-13.33	12	10	7.6	11	75				
" " "	7 29.13	-5.86-5.56	29.15	-5.83	-5.83	29.10	-3.33-3.33	12	11	4.7	12.5	65.5				
" " "	8 29.15	-2.78-2.78	29.12	0.00	0.00	29.12	-0.56	12	11	4.7	13.5	65.5				
" " "	9 29.07	-0.56-0.56	29.13	-10.56	-10.56	29.42	-12.22	16.8	13.5	6.5	12	9.5				
" " "	10 29.65	-10.83-10.83	29.44	-3.06	-3.06	29.32	-1.67	11	9	6.5	16	69				
" " "	11 28.79	-0.00-0.00	28.73	-0.56	-0.56	28.72	-1.11	11	12	2.5	14	65				
" " "	12 28.87	7.67-1.67	28.88	-6.10	-5.00	29.18	-6.67	16.5	14	7.4	14	78				
" " "	13 29.27	7.00-10.00	29.385	-11.11	-11.11	29.47	-11.67	12	10	6.6	13	63				
" " "	14 29.62	-9.44-9.44	29.73	-10.83	-10.83	29.75	-11.34	12	9.6	7.5	14	67				
" " "	15 29.77	-8.06-8.06	29.82	-8.06	-8.06	29.86	-8.33	13	10	6.6	13	63				
" " "	16 29.83	-6.94-6.94	29.83	-8.06	-8.06	29.83	-7.78	13	11	7.7	14	73				
" " "	17 28.75	-5.28-5.28	29.68	-7.50	-7.50	29.61	-5.86	15	12	6.8	8	72				
" " "	18 29.56	-3.06-3.06	29.67	-5.83	-5.83	29.65	-6.67	14	12	7.8	14.5	67.5				
" " "	19 29.79	-8.33-8.33	29.80	-8.61	-8.61	29.93	-8.61	13	11	7.8	14	73				
" " "	20 29.74	-8.89-8.89	29.95	-15.00	-15.00	30.00	-15.00	12	11	7.5	8.8	8.6				
" " "	21 30.00	-15.63-15.63	29.97	-22.50	-22.50	29.94	-21.11	12	9.5	7.5	14	73				
" " "	22 29.89	-16.67-16.67	29.93	-18.89	-18.89	29.92	-20.24	9	6.8	6.7	7	71				
" " "	23 29.91	-22.22-22.22	29.87	-22.78	-22.78	29.91	-22.22	8	6	7.2	6	70				
" " "	24 29.90	-21.67-21.67	29.915	-21.94	-21.94	29.97	-20.56	10	8	7.4	4	67				
" " "	25 30.01	-21.67-21.67	30.005	-20.94	-20.94	30.08	-22.78	12	9.5	7.5	14	71				
" " "	26 30.10	-26.11-26.11	30.08	-27.22	-27.22	30.122	-25.00	9	8.5	9.1	2	64				
" " "	27 30.11	-25.00-25.00	30.08	-20.28	-20.28	30.07	-21.11	9	6.2	6.7	2	82				
" " "	28 30.02	-22.78-22.78	29.965	-23.61	-23.61	29.93	-22.22	9	7	7.3	4	76				
" " "	29 29.80	-19.44-19.44	29.76	-17.78	-17.78	29.75	-17.22	9	7	7.3	4	75				
" " "	30 29.70	-8.33-8.33	29.61	-5.28	-5.28	29.65	-7.22	11	8.2	7.9	9.5	8.5				
" " "	31 29.62	-14.17-14.17	29.54	7.36	7.36	29.62	-8.33	9	7	7.3	8.5	82				
AVERAGE		29.66 32°-11.1	32°	29.65	-11.4	29.68 32°-11.5	11.8 9.5 7.9 10.1									

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning should be used. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the morning sheet. Same instruments to be used in all hygrometric observations.

Barometer corrected to 32° (degrees Fahrenheit) -

Gloucester, for the month of October, 1879.

DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.						REMARKS.
	M.	10 P. M.	No.	Relative humidity.	Dry bulb.	Wet bulb.	
				WIND.	WEATHER.		Relative humidity.
57	14	10	57	S/N	foggy	0	Snow on deck.
61	12	11	88	N/N	fc	0	" "
63	12	12	74	57	N/E	0	Ice on deck.
69	14	12	78	E/N	fc	0	" "
70	12	10	74	N/N	fc	0	" "
71	15	10	48	S2	snowy	0	Snow on deck.
71	14.5	12	73	S2	fc	0	" "
72	13	12	73	E/N	snowing	1.7858	0
72	14.5	12	70	E9E	"	0	" "
65	16	13.5	74	ESE	0C	0	" "
73	17.5	16	75	E	0C	0	Deck water from melted snow
74	14	12	78	W/S	snowy	0	Snow on deck
70	15	13	78	W	S	0	" "
70	15	12	68	W/N	S	0	" "
66	14	12	78	WSW	S	0	" "
77	15	12.5	73	ESE	S	0	" "
68	14	11.5	72.5	E/S	0C	0	" "
79	15	13.5	83.5	WNW	0C	0	" " Cartonie derived Taken at 8 1/2 P.M.
79	15	13	78	NW	0C	0	" "
81	14.5	14.5	74	WN	0C	0	" "
73	11	8.5	69	W	0C	0	" "
86	10.5	9	83	NW	0C	0	" "
70	13	11	77	WNW	0C	0	" "
87	9	7.5	79.5	WNW	0C	1.7858	0
87	10.8	9	77	NW	0C	0	" " Air taken at 10 P.M.
85	10.5	8.8	76	WNW	0C	0	" "
82	13	10.5	71.5	NW/W	0C	0	" "
74	9	7	73	clm	fc	0	" "
75	11	8	63	SS2	fc	0	" "
71	17	14	68	NE/S	0C	0	" "
82	16.5	14	74	W	0C	0	" "
72	14.5	11.5	68.7	WNW	0C	1.47	0 dry

ng should be selected. The results will not be entered unless the observer is certain of their accuracy.
umn of Remarks.

3
Oct 1 1879

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z .

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S.

SPAR DECK.

PLACE.	DATE.	Barometer.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			
			Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Dry Thermometer	Attached Thermometer	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Dry bulb.	Wet bulb.	Relative humidity.
In the Pack	1 29.47	-12.22-12.22	29.45	-13.61		29.54	-15.28	-15.28	16.5	13.8	72.2	16	11	13.8	72.2
" "	2 29.54	-16.67-16.67	29.55	+15.00	+15.00	29.50	-16.67	-16.67	13	11	67	14	11	18	11
" "	3 29.44	-16.11-16.11	29.42	-14.72	-14.72	29.41	-16.39	-16.39	13	11	67	15	11	18	11
" "	4 29.41	-16.67-16.67	29.38	-16.67	-16.67	29.40	-16.39	-16.39	13.5	9	70	18	11	18	11
" "	5 29.38	-16.11-16.11	29.38	-16.11	-16.11	29.45	-17.50	-17.50	14	12	28	14	11	17	11
" "	6 29.44	-23.06-23.06	29.455	-17.78	-17.78	29.56	-17.22	-17.22	11	9	77	13	11	17	11
" "	7 29.74	-20.88	29.685	-21.11	-21.11	29.77	-19.44	-19.44	16	18	69	16	11	17	11
" "	8 29.77	-18.61	29.74	-20.00	-20.00	29.78	-20.00	-20.00	17.5	14.5	70.5	14.5	11	17.5	11
" "	9 29.71	-20.56	29.66	-20.00	-20.00	29.73	-16.94	-16.94	14.5	12.5	78	15	11	17.5	11
" "	10 29.76	-18.89	29.885	-25.28	-25.28	29.95	-27.50	-27.50	16	15	79	12	11	18	11
" "	11 30.10	-28.06	29.96	-23.61	-23.61	29.96	-17.80	-17.80	17	14	70	17.5	11	17	11
" "	12 29.85	-31.11	29.752	-27.22	-27.22	29.74	-28.50	-28.50	13.5	11	57.5	15	11	16.8	11
" "	13 29.72	-24.44	29.77	-28.89	-28.89	29.88	-23.89	-23.89	12.5	10	75	15	11	17.8	11
" "	14 29.74	-20.56	29.775	-22.23	-22.23	29.89	-24.44	-24.44	13	10.5	71.5	12	11	18.2	11
" "	15 30.24	-22.78	30.28	-21.39	-21.39	30.24	-20.56	-20.56	13	10.5	71.5	16.5	11	17.9	11
" "	16 29.82	-16.56	29.62	-11.83	-11.83	29.54	-8.33	-8.33	15.5	13	74	12.5	11	17.8	11
" "	17 29.32	-5.2	29.375	-6.28	-6.28	29.56	-11.39	-11.39	15.5	13.5	80	15.5	11	18.6	11
" "	18 29.64	-14.44	29.75	-17.50	-17.50	29.76	-20.50	-20.50	18	11	77	16.5	11	17.4	11
" "	19 29.69	-21.67	29.645	-21.11	-21.11	29.63	-20.56	-20.56	17	14.5	75	15	11	16.8	11
" "	20 29.52	-16.67	29.45	-13.89	-13.89	29.53	-11.39	-11.39	18	11	77	12	11	17.1	11
" "	21 29.62	-21.11	29.44	-23.33	-23.33	29.71	-26.67	-26.67	15.5	13	74	12	11	17.6	11
" "	22 29.41	-23.33	29.15	-18.89	-18.89	28.92	-13.33	-13.33	16	13	69	11	11	16.9	11
" "	23 28.84	-5.00	28.84	-5.83	-5.83	28.92	-10.00	-10.00	16.5	13.5	79.5	16	11	17.9	11
" "	24 29.21	-19.44	29.44	-20.00	-20.00	29.63	-20.56	-20.56	14.5	11	63	13.5	11	17.1	11
" "	25 29.91	-22.22	30.10	-23.89	-23.89	30.30	-18.33	-18.33	10	8	74	14.5	11	17.8	11
" "	26 30.34	-17.22	30.32	-13.44	-13.44	30.30	-12.22	-12.22	15	14	89	14.5	11	17.3	11
" "	27 30.11	-11.11	30.10	-10.28	-10.28	30.05	-10.56	-10.56	18	11	77	15.5	11	17.4	11
" "	28 30.02	-10.00	30.22	-9.44	-9.44	30.32	-10.00	-10.00	17	15	80	13.5	11	18.2	11
" "	29 30.23	-11.11	30.26	-11.61	-11.61	30.29	-11.11	-11.11	13	12.5	94	16	11	17.5	11
" "	30 30.28	-12.22	30.29	-13.89	-13.89	30.30	-15.56	-15.56	17	14	70	17	11	17.1	11

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning should be used. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log book. Same instruments to be used in all hygrometric observations.

+ Barometer corrected to 82° F. Owing to the low temperature the wet bulb is worthless, & the simple wet and dry bulb method of reading will be discontinued.

, for the month of November, 1879.

DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.					REMARKS.
	P. M.	10 P. M.	No.	WIND.	WEATHER.	
Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.			Carbonic acid corrected for Temp and Pressure, per 1,000 columns.
						Number of sick, excluding injuries.
79 14 13 89 NW/N snow	0					0
68 15 18 78 NW/0 0c	0					
68 18 15 71 NW 0c	0					
62.5 18 15 71 N/E 0c	0					2.34300
62 12.5 14.5-20.5 NW 0c	0					
77 18 11 77 SSW 0c	0					
79 17 14 70 clear 0c	0					
67.5 16 14 79 clear 0c	0					
78 17.5 14.5 68.5 S/N 0c	0					
88 20 16.5 64.5 SW/S 0c	0					0
74 14 14 79 clear 0c	0					
68 12 10 76 8 0c	0					0
78 15.5 18 74 SW/S 0c	0					
82 16 13.5 74 clear 0c	0					
79 14.5 13 83 NW/W 0c	0					
78 15 12.5 73 S/E 0c	0					
86 17 15 80 SSW 0c	0					0
74 18 15 71 NW/W 0c	0					0
63 14 11 67 N/E/N 0c	0					
76 16.5 14 74 N/E 0c	0					
76 15.5 12 68 N/E 0c	0					
69 16 13.5 74 N/E 0c	0					
79 17.5 14.5 70.5 SW/S 0c	0					
72 11 9.5 81 SW/W 0c	0					
78 12.5 11 81 SW/W 0c	0					
73 12 10.5 82 S.0.2 0c	0					
74 15 13 78 90.2 0c	0					
83 20 17 72 S/E 0c	0					1.079
94.5 16 15.5 94.5 S 0c	0					
70 13 11.5 82.5 S/E 0c	0					
74.7 15.6 13.3 75.6 18th day 0c	1.711	0				

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.

umn of Remarks.

last readings on deck

or read & set down as

new things from this time as they are

Surgeon, U. S. N.

h
6281 ml

h
6281 ~~unmarked~~

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748+.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. : : capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Arctic* *Str. 100*

SPAR DECK.

BERTH DECK

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.
In the Rack	1	30.42	-16.67			30.48	-17.50			30.55	-19.44			13.5 11.5 7.2
"	2	30.64	-21.67			30.64	-21.50			30.70	-23.33			12 10 7.6 14
"	3	30.62	-21.67			30.295	-21.28			30.48	-21.11			9 8 8.6 6.5
"	4	30.32	-21.11			30.22	-19.72			30.22	-20.56			13.5 12 8.3 15
"	5	30.18	-17.78			+30.18	-22.78			30.24	-25.00			14 13.5 94.5 13
"	6	30.32	-28.33			+30.32	-25.78			30.30	-30.00			12 10.5 21 12 17.6
"	7	30.24	-30.00			30.19	-30.28			30.32	-29.72			13.12 8.8 16 16.9
"	8	30.49	-27.22			30.475	-26.11			30.48	-27.72			8 7 8.6 16 18.7
"	9	30.18	-24.67			30.07	-19.72			29.27	-17.78			8 7 8.6 16 18.7
"	10	29.61	-19.72			29.70	-15.56			29.64	-13.89			11 10 8.7 12.5 17.5 15
"	11	29.80	-13.89			29.56	-13.61			29.74	-14.44			15 13.5 8.8 16 18.7
"	12	29.99	-8.67			30.04	-21.89			30.16	-28.33			15 12.5 7.8 15 18.85
"	13	29.92	-21.11			29.784	-16.11			29.80	-14.44			15 12.5 8.0 13.5 18.8
"	14	30.06	-26.00			30.193	-28.78			30.30	-28.38			13 12 8.3 17.5 17.5
"	15	30.02	-20.66			29.92	-18.06			30.03	-19.44			13 14 8.4 16 19.4
"	16	30.30	-29.44			30.38	-32.28			30.58	-32.22			12 10 7.6 11 15
"	17	30.31	-27.22			30.03	-21.11			29.80	-16.67			14 13 8.9 12.5 18.80
"	18	29.92	-21.11			30.08	-34.56			30.38	-32.22			15 13.5 8.5 14.5 17.5 18.8
"	19	30.32	-32.22			30.10	-28.06			30.05	-18.89			14 13 8.9 11.5 18.8
"	20	30.75	-16.11			29.575	-13.22			29.44	-11.11			11.5 10 8.2 15 18.8
"	21	29.08	-17.78			29.04	-22.56			29.33	-28.89			15 14 8.9 16 18.8
"	22	30.54	-28.33			29.82	-27.67			29.96	-25.56			14 12.5 8.5 14 18.85
"	23	31.12	-26.67			30.096	-28.22			29.13	-27.78			16 14.5 8.4 15 18.85
"	24	30.00	-20.56			29.815	-18.72			29.90	-18.89			16 14.5 8.4 16.5 18.8
"	25	30.00	-20.00			29.97	-16.11			29.87	-14.44			16 15 8.9 16 18.8
"	26	29.64	29.57			29.56	-14.11			29.52	-15.00			15.5 14 8.4 15.5 18.8
"	27	29.45	-25.56			29.505	-21.50			29.64	-12.22			20 18.5 8.6 17 18.8
"	28	29.92	-32.22			30.01	-31.67			30.02	-32.39			15 18 7.8 16.5 18.8
"	29	29.90	-21.44			29.84	-31.11			29.84	-32.22			14 13 8.9 15 18.8
"	30	29.97	31.67			29.72	-31.11			29.70	-31.67			17.5 16 8.5 15 18.8
"	31	29.69	-28.89			29.70	-27.78			29.61	-29.44			17 16 8.5 15.5 18.8
AVERAGE		30.11	-23.6			29.98	-22.3			29.97	-23.5			14.1 12.5 8.3 14.1 18.8

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning should be used. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the same column. Same instruments to be used in all hygrometric observations.

Barometer corrected to 32° F

South

for the month of December, 1879.

DECK.		AVERAGE NUMBER OF SHIP'S COMPANY.					REMARKS.	
P. M.	10 P. M.	No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.		
Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.					
72 13 5 77.75 14 12 78 N	6c	0	Atmosphere charged with steam from engine in deck					
76 15 72.5 13 12 88 N	0c	0	Atmosphere charged with steam from engine in deck house					
84 18 92.5 13 11 72 E	6c	0	"					
83 18 78 12 11.5 94	clear	6	"					
92 18 77 12.5 78.5 76.5	W/W	6c	"					
21 10 78 17 14.5 77.5	W/N	6c	2	"				
88 18 69 14 14.5 84	24.5 2	6	0	"				
11 15 82.5 10 8 84 2 1/2	8	6c	1	"				
86 10 87 11.5 10.5 88	82	0c	0	"				
87 12.5 76.5 14.5 13 83	02	0c	2.510	Cabin, 10 P.M. 2.510				
83 15 89 14 12.5 83.5	0.5 W	0c	1/2	"				
73 6 88.5 15 13.5 93.5	W/S	6c	0	"				
80 3 83 18.5 16.5 77.25	E/N	0c	0	"				
83 5 75 16 15 89	W/N	6c	0	"				
84 1 89 16.5 15 84	E/N	6c	0	"				
76 1 75 17.5 16 85	W/N	6c	3.975	Birth Deck 10 P.M.				
89 5 80 18 15.5 90.5	2/N	0c	0	"				
68 5 18 16.5 14.5 88.25	W	0c	0	"				
84 10 82 15.5 14 83	E/N	0c	0	"				
81 5 89 17 16.5 85	E/N	0c	0	"				
81 5 16 15 84	W/N	Snow	0	"				
5 83.5 16.8 15 81	W/S	6c	0	"				
1/2 83.5 16.5 15 82	W/N	0c	0	"				
1/2 84 18 16 80	E/N	0c	0	"				
5 89 72 14.5 13 88	E/N	0c	0	"				
1/4 84 18.5 14.5 77.25	E/N	0c	1	"				
6 89 16.5 15.5 87.5	W	0c	4	"				
84 16 14 79	W	6c	1	"				
78 16 14.5 84	S	0c	1	"				
78 25 14 89	P	6c	1	"				
87.25 16.5 15.5 90.5	2/W	6c	2	"				
84.8 15.3 13.7 83.6	South	6c 17	2.510 ^{0.9}	Ramp				
		0c 14	0.975 ^{0.9}					

ng should be selected. The results will not be entered unless the observer is certain of their accuracy.
or early in the day, the results will be entered in the column of Remarks.

2881

2881
Lithuanian

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkoffer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .397484.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 705 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. : : capacity : : z.

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Arctic* *Aug 1861*

PLACE.	DATE.	SPAR DECK						BERTH DECK						
		10 A. M.						4 P. M.						
1	30.20	-38.8	29.42	-89.2	30.63	-89.4	19.5	18	82.5	17	150	15		
2	30.80	-39.4	30.88	-38.3	31.06	-39.4	14.	12	78	13	158	13		
3	31.05	-37.0	30.85	-52.7	30.72	-31.1	11.5	10	81.5	11	157	11		
4	30.36	-25.0	30.34	-20.9	30.29	-20.5	14	12	78	14	1325	16		
5	30.46	-32.2	30.57	-35.0	30.72	-34.4	15.5	14.5	89.5	14	138	16		
6	30.74	-33.3	30.72	-33.0	30.80	-30.0	17	16	80	14.5	138	13		
7	30.96	-28.0	30.57	-24.4	30.62	-24.7	16	15	88	15	1385	10		
8	30.64	-28.8	30.55	-27.2	30.56	-23.3	15	14	89	14	1383.5	11		
9	30.40	-27.2	30.33	-28.3	30.40	-23.8	16.5	11	46.5	15	1311	18		
10	30.50	-29.7	30.44	-28.3	30.43	-27.2	18.5	17.0	85	17.5	1375	19		
11	30.38	-28.3	30.36	-21.8	30.47	-21.1	19.5	17.5	91.2	18	1380	18		
12	30.49	-20.5	30.44	-23.8	30.45	-24.4	17.5	16	85	17	1385	11		
13	30.50	-32.5	30.38	-36.1	30.32	-37.2	16	15	89	17	1380	1		
14	30.14	-27.2	30.06	-35.8	29.96	-33.8	18	16.5	85	17	1380	14		
15	30.72	-32.2	29.66	-31.3	29.97	-34.1	18.5	13.5	83.5	15.5	1378	16		
16	29.51	-22.2	29.47	-25.0	29.60	-28.3	14	12	78	15.5	1381	11		
17	29.81	-32.8	29.92	-40.8	30.01	-41.1	17	15	80	16.5	1378	1		
18	30.14	-43.8	30.20	-44.7	30.24	-45.5	16	14	79	18	1385	16		
19	30.31	-44.4	30.24	-43.6	30.27	-42.2	17	16.5	85	12.5	1381	9		
20	30.20	-40.7	30.10	-38.8			12	10.7	82	13	1378			
21	29.93	-32.7	29.97	-36.6	30.06	-37.5	12	11.8	94	16	1379	1		
22	30.11	-38.3	30.22	-36.9	30.28	-33.0	13.5	12.8	98.5	13	1388			
23	30.47	-34.4	30.46	-35.2	30.45	-34.2	13.5	13.5	95	13	1388	1		
24	30.42	-31.0	30.42	-33.4	30.47	-32.1	14.5	13.5	88.5	14	1389	1		
25	30.51	-35.8	30.48	-35.3	30.46	-35.8	14.5	14	94	14.5	1385	1		
26	30.36	-35.0	30.24	-35.1	30.23	-35.5	14	15	89	14	1389	1		
27	30.04	-38.3	30.01	-35.4	30.04	-36.6	17	16	90	17	1390			
28	30.00	-35.5	29.95	-34.4	29.84	-33.1	14	13	89	17.5	1385			
29	29.82	-35.2	29.89	-35.5	29.98	-37.2	17.5	17	85	17	1380			
30	30.06	-40.8	29.99	-40.2	30.02	-39.7	15.5	14	84	15.5	1384			
31	36.08	-40.9	30.06	-40.8	30.10	-41.1	16	15	89	14	1389	1		
AVERAGE		30.32	-33.7	30.23	-33.7	30.31	-36.6	15.6	14.1	82.1	15.2	1383		

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Leeward, for the month of January, 1880.

DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.							REMARKS.
	P. M.	10 P. M.		No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	
Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.					Number of sick, excluding injuries.
80 15 13 88 WNW 6c	1	deck houses damp from steaming. Condensation in forecastle						
78 13 12 78 NW "	1	" "						
87 11.5 105 90.5 ENE "	1	" "						
58.25 16 14 79 02/2 "	1	" "						
78. 16 15 89 clou "	1	" "						
83 15.5 14 84 ENE "	1	" "						
88.5 83.5 15.8 14 81 212 "	1	" "						
88.5 83.5 14 12 78 "	1	" "						
100 18 16 80 WNW "	1	" "						
75 19.5 15.5 68.5 clou "	1	" "						
80 18 16 80 W 0C	1	" "						
76 18 16 80 clou "	2.854	" "						
80 18 16 80 6c	1	" "						
80 17 15.5 85 60/4 "	1	" "						
78 16 14 79 W/S "	1	" "						
78.5 81 17 15 80 WSW 0C	1	" "						
78 16 18 70 WNW 6c	1	" "						
77.5 88 16.5 14.5 81.5 NW/N 6c/3	1	" "						
82 9.5 8 80 WNW "	1	Forecastle damp from leak in bulk in bows, pumps going continuously in deck houses						
78 clou 6s	1	" "						
79 12 10 76 WSW 6c	1	" "						
88 14 13 89 W/U "	1	" "						
88 14 13 89 W "	1	" "						
89 16.5 15 84 clou 0C	1	" "						
88.5 16.5 15.5 90.5 "	1	" "						
89 16 15 89 212 "	1	" "						
90 18 16 80 "	1	Wet from evaporation						
85 16 15 89 W/U "	1	" "						
80 17 15 80 212 "	1	" "						
84 17 15 80 "	1	" "						
89 15 14 89 W/U "	1	" "						
83 16.8 14 80.1 14 m th 82 st 82 nd 62 nd 02 nd 4	1	dump.						

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.
ur early column of Remarks, will be

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:
Two glass jars, cubic capacity marked in cubic centimeters.
India-rubber stoppers, and sheet india rubber to tie over necks of jars.
Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofter's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the glass and its alkalinity determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748+.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 7.95 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:
30 : observed height of bar : capacity : z.

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. Arctic *Alt. Jr. 2000*

SPAR DECK.

BERTH

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			4 P. M.
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.
In The Pack	1 30.07	-42.22		34.10	-41.94	30.13	-41.67	14	13	89	13	148	153	
"	2 30.08	-35.00		29.92	-31.94	29.82	-28.61	13	12	88	15	135	148	
"	3 29.98	-36.94		30.09	-39.44	30.198	-42.12	12	11	88	14	149	155	
"	4 30.08	-38.61		30.03	-34.44	30.025	-35.83	13	12	88	14	131	141	
"	5 30.07	-40		30.08	-35.00	30.24	-34.70	12	11	88	12	148	151	
"	6 30.07	-31.94		29.94	-30.17	29.88	-31.11	13	12	88	14	131	141	
"	7 29.79	-37.78		29.78	-39.17	29.91	-40.00	13	12	88	12	148	151	
"	8 29.98	-43.84		29.995	-42.83	30.03	-42.61	14	13	83	14	159	161	
"	9 30.02	-41.28		29.90	-42.22	29.91	-40.06	11.5	11	94	14	128	131	
"	10 29.71	-42.22		29.717	-42.33	29.655	-40.56	12	11	88	10.5	91	10	
"	11 29.617	-40		29.517	-39.17	29.58	-40.83	13	12.5	94	12	118	121	
"	12 29.545	-38.61		29.582	-37.30	29.725	-38.39	12.5	12	94	11.5	10.5	11	
"	13 29.775	-33.84		29.77	-32.22	29.78	-33.06	12.5	11.5	88	14.5	13.85	14.5	
"	14 29.81	-31.39		29.78	-34.06	29.77	-37.50	12.5	11	82	11	107	111	
"	15 29.48	-33.61		29.43	-33.33	29.56	-38.89	15	14	89	12.5	11.85	12.5	
"	16 29.75	-43.61		29.87	-43.41	29.87	-40.78	13	12	88	16.5	14.5	16.5	
"	17 29.60	-36.67		29.18	-34.17	28.78	-28.33	12.5	11.5	88	12	118	121	
"	18 28.62	-29.33		28.808	-30.83	29.06	-35.88	10	9	86	12.5	11.85	12.5	
"	19 29.34	-40		29.47	-41.11	29.58	-41.67	13	12.5	94	10.5	10.5	11	
"	20 29.72	-42.22		29.71	-41.67	29.78	-41.67	13	12	88	10	9.5	10	
"	21 29.83	-43.33		29.81	-43.33	29.82	-43.33	8.5	8	93	8.5	8.5	8.5	
"	22 29.82	-41.67		29.77	-40	29.78	-40	12	11	88	11	9.5	11	
"	23 29.72	-33.17		29.78	-38.78	29.84	-40.56	12.5	12	94	7	6	8	
"	24 30.03	-40.83		30.08	-41.94	30.15	-41.67	9.5	9	93	10	9.5	10	
"	25 30.17	-39.66		30.183	-38.33	30.20	-40.56	8.5	8	93	10	9.5	10	
"	26 30.11	-40.63		30.08	-40.83	30.11	-42.78	13	12	88	12	118	121	
"	27 30.23	-39.44		30.23	-41.11	30.18	-40.56	10	9	86	12.5	11.85	12.5	
"	28 30.15	-40.83		30.19	-40	30.215	-42.22	11	10	87	12	118	121	
"	29 30.12	-42.08		30.13	-41.67	30.25	-43.89	10.5	10	94	12.5	11.85	12.5	
	30													
	31													
AVERAGE		29.97	-38.8	29.92	-38.7	29.85	-38.9	11.6	10.8	89.8	12.1	11.5	11.5	

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Jannette

, for the month of February, 1880.

BERTH. DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.						REMARKS.	
	10 P. M.	No.	WIND.	WEATHER.	Relative humidity.	Dry bulb.	Wet bulb.	
11	88	135	12	83	W ^W W	6C		1 Deck damp from condensation -
15	78	145	135	88.5	S/N	"		1
14	89	15	14	87	D ^W W	"		1
11	89	14	10	87	S ^W W	6C		1
11	88	14.5	13.5	88.5	D ^W W	6C		1
11	82	15	14	89	D ^W W	6C		1
10	88	15	14	89	S	6C		1
13	89	13	11	77	W/S	6C	130, 110m 5.30h	1
14	78	14	13	89	cl ^W	6C		1
10	81	13	12	88	S/N	6C		1
4	88	14	13	89	D ^W W	6C		1
4	58.7	12	11	88	D ^W W	6C		1
8	58.5	13	12	88	D ^W W	6C		1
21	87	14.5	13.5	88.5	D ^W W	6C		1
9	88	14	13	89	N ^W E	6C		1 Deck wet from leak through skin
8	74	12.5	11.5	88	N	6C		1
8	88	11.5	11	94	S	6C		1 Deck wet from condensation -
8	58.5	12.5	12	94	W	6C		1
21	74	12	11	88	W ^W W	6C		1
11	86	13	12	88	N ^W W	6J		1
9	93	13	12	88	W ^W W	6J		1
8	75	13	12	88	W ^W W	6C		1
9	85	8.5	8	93	W	6J		1
8	86	11	10	87	W/S	6P		1
9	86	13	11.5	83.5	cl ^W	6J		1
8	88	12.5	12	94	"	6C		1
2	94	14	13	89	"	6C		1
8	58	12	11.5	94	D ^W W	6C		1
9	82	10	9.5	98	N ^W E	6C		1
5	86.3	13	12	89.4	W ^W W	6C 19 W 5		1

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.
column of Remarks.

February 1880

7

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Brooks* *Atmospheric Observations*

BERTH DECK

SPAR DECK.

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.		
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.
<i>In the park</i>	1	30.50	-45.8	30.55	-45.72	30.66	-47.50	30.5	8.5	86.7	8	7.6	10.5
	2	30.64	-45	30.545	-42.78	30.295	-23.06	8	7.5	93	9	8.4	13
	3	30.34	-42.78	30.33	-41.11	30.37	-43.61	9.5	9	93.5	14	11.9	15
	4	30.35	-43.89	30.34	-42.22	30.40	-44.44	18	16.8	85	14	12.9	15
	5	30.20	-39.72	30.13	-38.53	30.11	-40.56	14	13	89	14	13.9	15
	6	30.13	-36.11	29.98	-34.44	30.00	-35.56	11	10	87	14	13.9	10
	7	29.90	-31.11	29.78	-30	29.72	-33.89	14	13	89	13	11.4	17
	8	29.54	-37.22	29.53	-36.11	29.57	-37.22	16.5	15	84	18	11.0	12
	9	29.66	-32.78	29.70	-30.00	29.84	-32.78	15.5	14	84	15.5	14.9	11
	10	29.84	-29.44	29.84	28.33	29.94	-32.22	17.5	16	85	16.5	15.4	15
	11	29.97	-33.89	30.08	-30.89	30.18	-25.20	18.5	16.5	85	16	14.1	16
	12	30.05	-20.28	29.94	-20.00	29.72	-21.11	14	14.5	84	14.5	13.8	18
	13	29.34	-18.33	29.44	-19.17	29.53	-23.33	17	15	80	18.5	16.5	16
	14	29.62	24.17	29.75	-24.44	29.94	-25.57	15	14	89	16.5	15.4	15
	15	30.16	-29.72	30.25	-30.00	30.24	-32.22	14	14.5	84	16	13.9	17
	16	30.48	-33.89	30.54	-32.78	30.65	-37.22	19.5	18	86	17.5	15.5	17
	17	30.60	-34.44	30.54	-31.67	30.58	-33.61	18	17	90	15.5	13.5	17
	18	30.40	-31.56	30.28	-28.33	30.23	-28.33	16	15	89	16.5	15.4	16
	19	30.11	-28.33	30.13	-27.50	30.14	-26.67	14.5	13	83	15.5	15.5	15
	20	30.18	-27.78	29.93	-25.28	30.03	-31.67	14.5	13	88	16.5	14.4	16
	21	30.21	-28.33	30.03	-26.83	29.70	-21.67	15.5	14.5	89.25	14.5	14.5	15
	22	29.34	-20	29.45	-21.94	29.57	-21.67	16	15	89			
	23	29.63	-22.28	29.76	-25.56	29.87	-29.44	17	16	90	12	15	17
	24	29.90	-26.39	29.92	-25.83	30.02	-28.61	14	13	89	13	13.8	14
	25	30.14	-28.00	30.14	-23.61	30.13	-21.67	16	15.5	83.5	18.5	16	17
	26	29.74	-17.78	29.71	-15.28	29.71	-15.28	19.5	17	76	19	11	16
	27	29.71	-12.22	29.71	-11.11	29.78	-11.11	15	14	89	18	16	18
	28	29.80	-8.33	29.72	7.64	29.71	-11.11	17	15	80	16.5	15.8	18.5
	29	29.86	-13.33	30.05	-15.28	30.19	-17.22	15	14	89	19	11	17
	30	30.35	-18.61	30.87	-18.06	30.40	-18.83	19	16	72	19	11	17
	31	30.34	-16.67	29.83	-12.22	29.87	-13.72	15	13	78	17	16	18
AVERAGE		30.03	-28.1	30.01	-27.7	30.04	-31.4	15.3	14	85.8	15.6	14	17.5

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Barrow

for the month of March, 1880.

DECK.		AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.	
P. M.	10 P. M.	No.		WIND.	WEATHER.		
Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.				
84.10.5	10	96	WN	6C		j Decks wet from steam + condensation.	
84.13	12	88	NNN	6C		1 " " " "	
84.89	12.5	105	93.2	SE		1 " " " "	
84.89	15	14	89	1C	clm	1 " " " "	
84.89	15	13	78	6C	2	1 " " " "	
84.89	10.5	10	96	6C	E	1 " " " "	
84.85	17	15	80	6C	E/10	1 " " " "	
84.80	12	15	80	6C	"	1 " " " "	
84.58	05	17	16	90	6C	clm	1 " " " "
84.84	8.5	14	84	6C	"	4.32(?) 1 Below deck 10pm	
84.84	16.5	15	84	6C	W	1 " " " "	
84.84	18	16	80	6C	SE	1 " " " "	
84.58	2.5	16.5	15	84	6C	NNNE	1 " " " "
84.84	15	14	89	6C	NNW	1 " " " "	
84.62	17	15.5	85	6C	W/E	1 " " " "	
84.75	17.5	16	85	6C	N	1 " " " "	
84.94.5	17	16	80	6C	NNW	1 " " " "	
84.84	16	15	89	6C	W	1 " " " "	
84.94.5	15	14	89	6C	W	1 " " " "	
84.84	16.5	15	84	6C	EW	1 " " " "	
84.84	15	14	84	6C	WSW	1 " " " "	
84.84	16	15	80	6C	WSE	1 " " " "	
84.80	17	16	80	6C	WSW	1 " " " "	
84.88	14	18	89	6C	SW	1 " " " "	
84.76	17	15	80	6C	SW	1 " " " "	
84.81	16	15	89	6C	NZ	1 " " " "	
84.80	18	16	80	6C	E	1 " " " "	
84.84.5	17	15.5	85	6C	ESE	1 " " " "	
84.81	17	15	80	6C	SW	1 " " " "	
84.81	17.5	16.5	81	6C	NNW	1 " " " "	
84.90	18.5	17	85	0CS	E NE	13.8 2.349 1 10pm	
84.84.7	15.8	14.5	80	6C	SW	2.369 1 cont	

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.
early in the month of Remarks.

8

2351 years BC

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z.

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Jeanette

Atmospheric Observations on board U. S. S.

BERT

SPAR DECK.

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.		
		Barometer.	Attached Thermometer.	Dry bulb.									
In The Pack	1	29.84	74.17	72.76	29.83	-14.44	29.79	76.39	11.5	105.88	14.5	11	11
"	2	29.43	71.58	71.58	29.27	-7.50	29.29	-14.44	9.5	8.5	86.713	88	16
	3	29.40	75.56	75.56	29.42	-18.89	29.51	-23.89	11	10	87.18	88	18
	4	29.60	-23.89	-23.89	29.64	-21.67	29.73	-24.67	4	8	83.175	85	17
	5	29.80	-28.53	-28.53	29.84	-25.72	29.94	-28.89	9.5	9	93.514	78	1
	6	29.99	-22.22	-22.22	29.99	-25.56	29.99	-30.83	9	7.5	79.514.5	83	1
	7	29.98	-25.00	-25.00	29.99	-22.78	30.06	-26.11	7	6	85.14	89	1
	8	30.14	-21.67	-21.67	30.14	-19.89	30.21	-22.50	8	7.5	93.185	90	1
	9	30.20	-20.83	-20.83	30.18	-18.33	30.18	-17.44	9	8	86.15	89	16
	10	30.02	-15	-15	29.95	-12.22	30.05	-15	12	11	88.15	87	1
	11	30.10	-11.94	-11.94	29.94	-12.80	29.75	-13.89	13	12	88.195	18.25	1
	12	29.53	-11.11	-11.11	29.51	-8.33	29.53	-10	12.5	11	82.16.5	85	1
	13	29.48	-11.67	-11.67	29.57	-13.33	29.67	-12.50	12	11	88.17	80	1
	14	29.76	-15	-15	29.81	-11.67	29.86	-14.44	11	9	75.185	85	1
	15	29.84	-15	-15	29.82	-13.04	29.81	-15	16	15	89.185	85	2
	16	29.68	-13.89	-13.89	29.66	-11.67	29.70	-12.22	12.5	11.5	88.17	18.5	1
	17	29.61	-15.36	-15.36	29.51	-12.78	29.47	-15.56	12	10	76.16.5	85	1
	18	29.34	-10	-10	29.41	-8.72	29.53	-15.56	11	10	87.16	85	1
	19	29.68	-16.67	-16.67	29.76	-12.89	29.83	-14.44	15	14	89.15.5	14	1
	20	29.88	-12.78	-12.78	29.78	-9.56	29.81	-9.44	12.5	11.5	88.12.5	82	1
	21	29.74	-10	-10	29.70	-8.33	29.78	-16.67	13.5	12.88	15	18.15	1
	22	29.68	-8.33	-8.33	29.69	-8.89	29.77	-17.78	12	10.5	79.15.5	84	1
	23	29.81	-16.11	-16.11	29.83	-9.72	29.92	-14.11	9	8	86.11.5	87	1
	24	29.94	-10	-10	30.00	-9.64	30.06	-11.67	19				1
	25	30.09	-9.72	-9.72	30.10	-9.72	30.16	-2.0	11	10	87.19.5	16	1
	26	30.09	-8.89	-8.89	30.04	-8.83	30.02	-7.22	11	10	87.14.5	18	1
	27	29.96	-5.56	-5.56	29.95	-3.87	29.98	-5.56	12.5	11	82.17.5	85	1
	28	29.93	-4.44	-4.44	29.86	-5	29.84	-6.67	14	12	78.17	80	1
	29	29.74	-7.78	-7.78	29.70	-3.06	29.71	-12.78	11.5	10.5	87.14	85	1
	30	29.82	-5	-5	29.86	-1.54	29.94	-11.11	14	13	89.16.5	85	1
	31												
AVERAGE		29.80	-13.9	-13.9	29.79	-12.1	29.83	-16.2	11.2	10.4	85.9	15.8	

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the m.
The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in
Same instruments to be used in all hygrometric observations.

26

*Peculiarly favorable
circumstances*

, for the month of

April, 1880

BIRTH DECK.				AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.	
P. M.	10 P. M.	No.							
Dry bulb.	Relative humidity.	Dry bulb.	Relative humidity.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.		
14.5	12.78	14.5	13.5	89.5	SW	18C	1	Deck damp from condensation	
13	12.88	16	15	89	SW	OC, P	1	..	
12	88	15	14	89	SW	OC, f	1	..	
17.5	16.85	17	16	90	SW	OC, f	1	..	
14	12.78	15	13	78	NW	OC	1	..	
14.5	13.83	15.5	14	84	W, SW	OC	1	Bath deck damp. Spar deck frozen	
14	13.89	14.5	13	83	..	OC	1	..	
18.5	17.5	90	15	74	SW	63	1	..	
15	14.89	16.5	15	84	SW	OC	1	..	
15	14.89	17	16	90	SW	OC, m	1	..	
15	17.5	8.25	19	17.5	85.5	N, E	1	..	
16.5	15.85	17	17	90	E	OC	1	..	
11	15	80	18	15.5	75.5	W	OC, m	Open deck with fine melting	
16.5	17	85	18	16.5	85	OC, m	1	..	
16	17	85	20	18	81	OC	1	..	
17	8.5	85	17	14	90	NW, S	OC	..	
16.5	15	85	17	15.5	85	OC	1	..	
16	15	89	18.5	16.5	81.5	OC	1	Spar deck frozen + melting. BD damp from cleaning -	
15.5	14	84	16.5	15	84	N, NW	OC	.. dry -	
12.5	11	82	14.5	13	83	E, N, E	OC, m	.. damp condensation	
12.5	8.5	13	14	79	E	OC, P	1	..	
13.5	14	84	15	14	89	E, P	OC	..	
11.5	10.5	87	17	15	80	S, N, E	OC	..	
19	17	81	18.2	15.5	69	OC	1	..	
11.5	18	86	16.5	15	84	OC	1	.. from washing	
11.5	12.5	78	17	15	80	E, S, E	OC	.. dry -	
12.5	16	85	17	15.5	85	OC, S	1	..	
17	15.5	85	17	15.5	86	E, S, E	OC, m	..	
14	12.8	8.5	18	15.5	78.5	E	OC	..	
11.5	15	85	17.5	16	85	S, S, E	OC	..	
15.5	14.3	84.3	16.7	15.2	80.7	Outwardly	OC, 16 OC, 14	Wet or damp -	

the morning should be selected. The results will not be entered unless the observer is certain of their accuracy.

and in column of Remarks.

April 1882

9

100 60 1000 200 15
100 70 1000 200 15
100 80 1000 200 15
100 90 1000 200 15
100 100 1000 200 15
100 110 1000 200 15
100 120 1000 200 15
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For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars,

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods,

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

$$30 : \text{observed height of bar.} : : \text{capacity} : z.$$

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Jeanette

Atmospheric Observations on board U. S. S.

BERTH

SPAR DECK.

4

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			
		Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.	
<i>In the pack</i>	1 30.00	32° -4.44		29.97	32° -1.28		30.01	32° -1.33		12 10.5	82 -14.5	18	13	
	2 29.92	-6.34		29.87	-6.67		29.79	-8.89		6 5	85 -13	32	14	
	3 29.65	-6.11		29.46	-8.33		29.38	8.33		9.5	8 80 13	38	12	
	4 29.48	-10.28		29.61	-9.17		29.73	-10.56		12.5	11 82.5 16	39	15	
	5 29.75	-13.33		29.77	-16.11		29.81	-15.56		12 11	86 -14.5	79	11	
	6 29.90	-17.78		29.96	-19.44		30.06	-18.33		9	8 86 14.5	83	11	
	7 30.14	-13.61		30.13	-12.89		30.11	-18.33		9	7.5 79.5 11	37	11	
	8 29.78	-15.20		29.62	-11.50		29.60	-11.11		10	8.5 80 13	44	11	
	9 29.62	-6.11		29.73	-9.17		29.88	-7.44		9.5	9 98 15	78	11	
	10 30.14	-15		30.25	-13.61		30.30	-18.56		12	11 88 15	89	11	
	11 30.24	-15		30.18	-14.56		30.21	-11.11		12	11 88 15	89	11	
	12 30.19	-7.5		30.14	-13.84		30.14	-13.89		14	12 78 16	89	11	
	13 30.12	11.67		30.13	-11.11		30.16	-18.33		11	10 82 18	88	11	
	14 30.19	-13.89		30.22	-10.56		30.28	-16.11		8	7 86 13	62	11	
	15 30.21	-11.11		30.16	-10.56		30.28	-12.78		10	9 86 14	89	11	
	16 30.38	-9.44		30.28	-10.56		30.20	-11.67		14	13 89 11	97	11	
	17 30.03	-8.61		30.13	-8.72		30.25	-12.22		10.5	9.5 87.5 12	88	11	
	18 30.28	-8.89		30.23	-8.61		30.25	-12.78		9.5	8 80 10	86	11	
	19 30.24	-9.17		30.20	-5.56		30.21	-13.33		10	8 74 11	87	11	
	20 30.14	-9.72		30.06	-5.44		30.08	-10.00		9	7 73 9.5	76	11	
	21 29.75	-5.83		29.94	-2.94		29.98	-6.11		9.5	8 80 12.5	71	11	
	22 30.00	-4.72		30.01	-2.39		30.09	-6.11		9.5	8 80 13	88	11	
	23 30.13	-4.72		30.11	-4.44		30.11	-8.06		9.5	8 80 15.5	84	11	
	24 29.98	-8.33		29.89	-8.04		29.84	-8.89		9	7 73 14	85	11	
	25 29.83	-7.78		29.86	-6.11		29.90	-9.44		10	9 86 16	79	11	
	26 29.96	-3.33		29.96	-1.67		30.01	-7.22		13.5	12 83 17	70	11	
	27 30.13	-4.44		30.14	-4.17		30.20	-5.56		9.5	8.5 83 86	86	11	
	28 30.20	0		30.12	-1.67		30.07	-3.89		8	7 86 10.5	94	11	
	29 29.82	-1.39		29.88	0		29.90	-0.56		8.5	7 79.5 16.5	84	11	
	30 29.87	+ 0.83		29.80	-1.11		29.79	-2.78		9	8 86 13	88	11	
	31 29.66	-1.36		29.61	-0.56		29.64	-1.61		10.7	10 9.5 11.5	4	11	
AVERAGE		39.97	32° -8.4		29.98	32° -7.7		30.00	32° -10.6		9.9	8.9 83 10.6		

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the m
The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in
Same instruments to be used in all hygrometric observations.

Barometer 82°
Concrete

with

, for the month of May, 1880.

FEET. DECK.

AVERAGE NUMBER OF SHIP'S COMPANY

REMARK

P. M.	10 P. M.		No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.
	Wet bulb.	Dry bulb.					
45	25	78	15	13.5	83.5	0	0
45	25	78	14	13	87	002	0
45	25	88	12.5	11.5	88.25	W	0
45	25	89	15.5	13.5	79	N W	0
45	25	79	13	12	78	N	0
45	25	83	18	12	78	N	0
45	25	87	12	10	76	N 4/8	0
45	25	88	12.5	11	72	2	0
45	25	78	17.5	16	85	8	0 Cm. 8
45	25	79.5	14.5	14.5	79.5	W	0
45	25	82	14	12.5	88	W N W	0
45	25	87	14.5	12.5	78	"	0 Cm
45	25	88	12	11	88	N 4/8	0
45	25	82.5	14.5	13.5	89.75	2 N 2	0
45	25	83	13.5	12	83	2.12	0
45	25	87	11	10	87	0 2	0
45	25	88	14.5	12.5	78	0 2	0
45	25	86	11	9.5	81	0 2/1	0
45	25	87	12	10	76	0 2	0
45	25	85	76.5	85	76.7	2	0
45	25	71	11.5	9.5	75.7	2 N	0
45	25	88	16	14	79	2 N	0
45	25	84	16	14	79	0 2/2	0
45	25	85.5	15.5	13.5	80	2 1/2	0
45	25	79	18	15	71	"	0 Cm
45	25	70	17	14.5	75	- Cm	0
45	25	86	10	9	86	2 2/2	0
45	25	94	11.5	11	94	0 Cm	0
45	25	84	17	15	76	0 2	0
45	25	88	13.5	13	94	0 2/2	0 Cm
45	25	94	12.7	12	91.5	0 2	0
45	25	84.3	13.7	12.2	82	Poverty	12.6 19.0 C

The results will not be entered unless the observer is certain of their accuracy.

ertain of their accuracy.
J. W. G. M. A. N. D. B. L. E. R.
R. R. Surgeon, U. S.

Ed Surgeon, U. S. N.

10

2881
~~new~~ now

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters,
India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 75 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent, to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

$$30 : \text{observed height of bar.} :: \text{capacity} : z.$$

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S.

 Arctic *Arctic* *Arctic* *Arctic*

BERTH

SPAR DECK.

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			4 DRY BULB.		
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.		
<i>In the pack</i>	1 29.54 -0.56	29.49	44-0.28	29.56	-3.33	29.56	44-0.28	29.56	0	29.56	44-0.28	29.56	0	9.5 9.5 8.5 12	9.5	
	2 29.52 -3.33	29.47	44-0.28	29.54	0	29.54	44-0.28	29.54	0	29.54	44-0.28	29.54	0	8.7 8.6 10.5	9.5	
	3 29.83 -1.67	29.94	44-0.28	29.99	31-2.78	29.99	31-2.78	29.99	31-2.78	29.99	31-2.78	29.99	31-2.78	8.7 8.6 8.5	9.5	
	4 29.90 34.0	29.85	37.2 1.5 ⁹¹	29.85	37.1 1.5 ⁹¹	29.85	37.1 1.5 ⁹¹	29.85	37.1 1.5 ⁹¹	29.85	37.1 1.5 ⁹¹	29.85	37.1 1.5 ⁹¹	8.5 8.1 5.5 7.5 8.1 9.5	9.5	
	5 29.95 37.5 0.5 0	29.93	44-2.5 1.5 ⁹¹	29.80	30-3.33	29.80	30-3.33	29.80	30-3.33	29.80	30-3.33	29.80	30-3.33	6.5 5.5 9.5 13.5	9.5	
	6 29.35 35.0 0.5 0.5 100	29.38	36 0.2 0	29.53	27-3.33	29.53	27-3.33	29.53	27-3.33	29.53	27-3.33	29.53	27-3.33	9.8 8.6 8.5	9.5	
	7 29.73 28.3 -4	29.77	34-1.5-4	29.77	28-0.5-4	29.77	28-0.5-4	29.77	28-0.5-4	29.77	28-0.5-4	29.77	28-0.5-4	6.5 6 9.5 6	9.5	
	8 29.77 31-1.94-2.22	29.82	34-0-1.11	29.85	38-3.33-3.33	29.85	38-3.33-3.33	29.85	38-3.33-3.33	29.85	38-3.33-3.33	29.85	38-3.33-3.33	6.5 6 9.5 8.5	9.5	
	9 29.84 34-1.5-2	29.85	24-1-1.5 ⁹¹	29.74	27.5-4-4.5	29.74	27.5-4-4.5	29.74	27.5-4-4.5	29.74	27.5-4-4.5	29.74	27.5-4-4.5	8.5 8.6 9	8.5	
	10 29.52 33-2-2.2 100	29.45	36-0.2-0.5 ⁹¹	29.42	32.5-0.5-0.5 100	29.42	32.5-0.5-0.5 100	29.42	32.5-0.5-0.5 100	29.42	32.5-0.5-0.5 100	29.42	32.5-0.5-0.5 100	10.5 10 9.4 12.5	9.5	
	11 29.44 39+1.67+1.67 100	29.46	37.5+2.5+1.5 ⁹¹	29.56	31.5-0.5-0.5 100	29.56	31.5-0.5-0.5 100	29.56	31.5-0.5-0.5 100	29.56	31.5-0.5-0.5 100	29.56	31.5-0.5-0.5 100	10.5 9.4 12	10	
	12 29.50 31.5-2.5-2.5 100	29.67	33-0.5-0.5 100	29.74	34+0.5+0.5 100	29.74	34+0.5+0.5 100	29.74	34+0.5+0.5 100	29.74	34+0.5+0.5 100	29.74	34+0.5+0.5 100	8.5 8 9.5 14	10	
	13 29.87 39.5+2+1.5 91	29.82	41+4.5+3	29.74	36-3.5-4	29.74	36-3.5-4	29.74	36-3.5-4	29.74	36-3.5-4	29.74	36-3.5-4	7.5 7 9.5 1.5 9.5	9.5	
	14 29.80 37 0 -0.5-8.5 29.95	36+0.5-0.5-0.5	29.95	30-1.5-2	29.95	30-1.5-2	29.95	30-1.5-2	29.95	30-1.5-2	29.95	30-1.5-2	29.95	30-1.5-2	8.5 8.6 9.5	9.5
	15 29.92 31-1-1.5-90	29.96	33.5+2 0	30.00	30-1.3-1.6	30.00	30-1.3-1.6	30.00	30-1.3-1.6	30.00	30-1.3-1.6	30.00	30-1.3-1.6	8.5 8 9.5 11	9.5	
	16 30.04 29-2-2.5 74.5 30.04	35+4.5 0	91	30.05	29.5+4.5	91	30.05	29.5+4.5	91	30.05	29.5+4.5	91	30.05	29.5+4.5	10 9.5 9.5 11.5	9.5
	17 30.02 31.5 0-0.5 8.5 29.20	35+3+2	80	29.73	30.5-1-1.5	91.5	10 9.5 9.5 10	29.73	30.5-1-1.5	91.5	10 9.5 9.5 10	29.73	30.5-1-1.5	91.5	9.5 9.5 9	8.5
	18 29.40 29-2.5-3 90	29.41	37-3-3.5	29.45	31	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	8 7.5 9.5 10.5	10	
	19 29.54 35+0.8+0.5	29.62	39+5+3.5 74.5	29.65	31	0-0.5 8.5	9 8.5 9.5 10	29.65	31	0-0.5 8.5	9 8.5 9.5 10	29.65	31	0-0.5 8.5	9 8.5	9.5
	20 29.54 34+0.5+0.2	29.37	35+0.5+0.5 100	29.22	35.5+1.1+1.1 100	29.22	35.5+1.1+1.1 100	29.22	35.5+1.1+1.1 100	29.22	35.5+1.1+1.1 100	29.22	35.5+1.1+1.1 100	8 7.5 9.5 10.5	9.5	
	21 29.38 36+8+0.5	29.32	38+1.1+0.8	29.20	34 0 0	100	8 8 100	29.20	34 0 0	100	8 8 100	29.20	34 0 0	8 8 100	8.5 9.5 9.5	
	22 29.32 38+5 0 90	29.44	38.5+5.5+3.5 64	29.57	32+1.6+1.6 100	29.57	32+1.6+1.6 100	29.57	32+1.6+1.6 100	29.57	32+1.6+1.6 100	29.57	32+1.6+1.6 100	8.5 8 9.5 9.5	9.5	
	23 29.67 38.5+1.5+1 91	29.67	39+2.5+1.5 85	29.67	34+0.2 0	96	8.5 8 9.5 9.5	29.67	34+0.2 0	96	8.5 8 9.5 9.5	29.67	34+0.2 0	96	8.5 8 9.5 9.5	9.5
	24 29.50 38+2+1.5 91	29.46	37+2+1	29.76	33 0.5 0	90	9.5 9 9.5 9.5	29.76	33 0.5 0	90	9.5 9 9.5 9.5	29.76	33 0.5 0	90	9.5 9 9.5 9.5	9.5
	25 29.92 42+4.5+3.5 72.5	30.07	37+6+5 85	30.04	38+1.5+1 91	8 7.5 9.5 9.5 10	30.04	38+1.5+1 91	8 7.5 9.5 9.5 10	30.04	38+1.5+1 91	8 7.5 9.5 9.5 10	30.04	38+1.5+1 91	8 7.5 9.5 9.5 10	9.5
	26 30.08 41+2.2+2.2 100	30.10	46+7+6 85	30.12	36+1.6+1 91	11	10 8.7 14	30.12	36+1.6+1 91	11	10 8.7 14	30.12	36+1.6+1 91	11	10 8.7 14	9.5
	27 30.14 39.5+2+1.5 91	30.12	44+4.5 4	30.22	37+2+1.5 91	8 7 8.6 10	30.22	37+2+1.5 91	8 7 8.6 10	30.22	37+2+1.5 91	8 7 8.6 10	30.22	37+2+1.5 91	8 7 8.6 10	9.5
	28 30.37 43+3+2.5 91.5	30.40	49+7+6 85	30.40	39+2+1.5 91	9 9 9	9 9 100	30.40	39+2+1.5 91	9 9 9	9 9 100	30.40	39+2+1.5 91	9 9 9	9 9 100	9.5
	29 30.38 39+2.3+2.5 85	30.36	47.5 12.7 10 69	30.06	41+3.3+2.5 85	8.5 8 9.5 10	30.06	41+3.3+2.5 85	8.5 8 9.5 10	30.06	41+3.3+2.5 85	8.5 8 9.5 10	30.06	41+3.3+2.5 85	8.5 8 9.5 10	9.5
	30 30.35 43+3.5+3 91.5	30.32	44 10 7.5 68	30.27	37+2+1.5 91	9 9 9 9.5 9.5	30.27	37+2+1.5 91	9 9 9 9.5 9.5	30.27	37+2+1.5 91	9 9 9 9.5 9.5	30.27	37+2+1.5 91	9 9 9 9.5 9.5	9.5
	31 <i>Answer</i> -29.78 35.4 25.0 0.8 90	29.78	39.5 2.4 1.8 83	29.78	36.5 -1.5 -3 92.5	8.5 8.5 8.5 8.5 8.5	29.78	36.5 -1.5 -3 92.5	8.5 8.5 8.5 8.5 8.5	29.78	36.5 -1.5 -3 92.5	8.5 8.5 8.5 8.5 8.5	29.78	36.5 -1.5 -3 92.5	8.5 8.5 8.5 8.5 8.5	9.5

AVERAGE -----

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

January

, for the month of

June

, 1880.

BERTH DECK.

AVERAGE NUMBER OF SHIP'S COMPANY.

REMARKS.

10 P. M.	No.	REMARKS.
10 P. M.		
Dry bulb.		
Wet bulb.		
Relative humidity.		
WIND.	WEATHER.	
		Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.
		Number of sick excluding injuries.
12 15 94 9.7 9 90.5 02/0 0.C.S	1	A. S. Snow - B. S. dry -
105 10 94 10 10 100 008/2 0.C.S	1	" " melting " " damp
85 8 93 10.8 10 90 W/N 0.C	1	" " dry " " damp.
95 9 93.5 10.5 10 94 008/2 0.C	1	" " " "
135 13 94 15.5 14 94 NW 0.C	"	" " " "
85 8 93 13.5 12.5 88.5 N 0.C	1	" " " " dry
55 92.5 8.5 7.5 81 NW 0.C 2307	1	10 AM 10 "
85 8 93 10.5 10 94 W 0.C	1	" " " "
9 59.3 11 10 87 8/0 0.C	1	" " " "
125 2 94 14 12.5 94.5 ENE 0.C.S	1	A. S. melting snow, " " damp.
12 12 100 10 10 100 023/2 0.C	1	" " damp " " "
14 4 100 13.5 13 94 W 0.C		" " melting snow, " " wet snow
15 11 94 13 12.5 94 044/W 0.C	1	" " damp " " damp.
95 9 93.5 12 11.5 94 W 0.C	1	" " " "
11 95 98.5 11 10.5 93.5 W/N 0.C	1	" " Day ② " " " " dry
115 1 94 14 13.5 94.5 WNW 0.C	1	" " C. " " "
9 58 98 9 8.5 98 0W/W 0.C	1	" " melting snow " " wet
105 0 94 12 11.5 94 NW 0.C	1	" " dry " " " " dry.
10 95 98.5 12.5 12 94 NW 0.C	1	" " " " "
105 95 100 12 11 100 0 0.C.S	1	air saturated snow slush Rain
85 8 98 10.5 10 94 0W/2.8 0.C.S	2,495 1	" "
15 9 93.5 12 11.5 94 W/S 0.C	1	Deck comparatively dry -
10 0 97 10 12.5 94 8 0.C	1	" " " "
85 8 93 9 8.5 93 0W/S 0.C.S	1	Both decks wet. Rain -
10 86 12.2 12 98 NW/N 0.C	1	" " " " dry
14 85.94, 574.5 14 94 N/S/N 0.C	1	decks washed down
10 95 93.5 13.2 13 98 W 0.C	1	" " " " dry " "
105 0 94 11 10.5 93.5 N 0.C	1	" " " "
10 95 93.5 11.2 11 97 NW 0.C	1	" " " "
95 9 93.5 11.2 12.5 91 9.8 0.C	2,262 1	" "
105 8 94 11.1 11.1 93.0 wetting	AC 15 BD 10 pm BC 15 10 pm	" "
	2	17 dry 18 wet
	2,421.8	

the unit should be selected. The results will not be entered unless the observer is certain of their accuracy.

J. M. A. Lubbock
R. A. M. Surgeon, U. S. N.

11

ess 1 nine

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Molar's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Peffenkoffer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and its alkalinity determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .29748.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. : : capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S.

Arctic Atm

BERT

SPAR DECK.

PLACE.	DATE.	10 A. M.				4 P. M.				10 P. M.				10 A. M.					
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.		
In the park	1	30.14	39	3	2	83	30.12	39	105	9	81	30.08	37	25	2	91	9.5	9 96 8	
	2	30.00	42	5	4	84	29.94	52	21	95	29.84	42	35	3	83.5	7.5	7	92.5 8.8	
	3	29.69	45.5	4.4	4.4	100	29.67	60	14.5	11.5	67.5	29.66	44	4.5	4	91.5	9	8.5 7.3	8
	4	29.71	45	5.5	4.5	86	29.74	49	5.5	5	95.5	29.74	37.5	1	+5	90.5	8.7	8	90.5 12
	5	29.70	41	2.5	2	91	29.68	41.5	3	2.5	91.5	29.68	34	1.5	1	91	10.2	10	97 11.5
	6	29.64	39.5	3	2.5	91.5	29.61	42	3.5	3	91.5	29.57	35	1.8	1	94.5	10.3	10	96 10.8
	7	29.50	37	1.94	1.94	107	29.51	38.5	9.3	3	95	29.54	36	1.9	1.6	13	13	100	13.8
	8	29.62	41	4.5	4	91.5	29.63	42	5	4.5	92	29.63	38.5	2.5	2	94.5	13.2	13	98 9.5 11.5
	9	29.63	37.5	2	1.5	91	29.63	39	4	2.5	74.5	29.59	35	1.1	1.1	100	9.5	9	96 8.5 10.2
	10	29.68	35.5	1.11	1.11	100	29.48	34.5	0.5	0.5	100	29.48	34	1.11	1.11	100	7.5	7.5	100 8
	11	29.58	39.2	1.5	91	29.58	44	8.5	7	79.5	29.54	39	2.5	2	91	9.5	9	96 11.5	
	12	29.56	44	5.8	5	95.5	29.58	50.5	16	8	24	29.59	39	2.5	2	91	10	9.5	9.3 8.5 9.8
	13	29.60	44	8	4.5	92	29.61	44.5	10	8	74	29.65	36.5	2.2	2.2	100	9.5	9	96 9.5 9.8
	14	29.90	37	2	1.5	91	29.96	39	3.5	2.5	83	29.98	34	.5	0	90	7	6.5	92.5 8 8.6 11
	15	29.95	41	3.5	3	91.5	29.84	37	2	1	82	29.77	37	.5	.5	100	7.5	7	92.5 9.5 9.6 10
	16	29.76	35	1	1.5	70.5	29.74	35	1	.5	90.5	29.72	33	.2	.0	96	6.5	6	92.5 9.5 9.6 10
	17	29.42	35	1.3	1.3	101	29.31	34.5	1	.5	90.5	29.56	33	.2	.2	100	10.2	10	97 6.2 7.15
	18	29.78	35	.8	.5		29.78	37	2.2	0	78	29.78	33	.2	0	96	9	8.5	9.3 13.5 14.13
	19	29.79	35	.2	0	96	29.74	39	3	2	83	29.65	33	.5	0	90	10	9.5	9.3 10.2 11.2
	20	29.42	36	1.5	1	91	29.42	44	4.5	3.5	88.5	29.44	36	1.5	1	91	10.5	10	94 10.5 9.4 12
	21	29.38	34	1.5	1	91	29.47	39	4	3	83	29.51	33	0	-5	90.5	9.5	9	92.5 8.2 9.7 1
	22	29.52	35.5	.5	.5	100	29.59	34.5	2	1.5	91	29.62	33	.5	.5	100	7.5	7	92.5 7.5 9.5 9
	23	29.64	33.5	0	0	100	29.67	35	3.5	1.5	29.64	31	-5	-8		8.5	8	92.5 10	
	24	29.55	33	0	-1.5	90.5	29.56	33	.5	0	90	29.60	32	0		6.5	6.5	100 14	
	25	29.67	35	1.5	.5	81.7	29.68	35	1	.5	90.5	29.60	33	0		8	7	84 7.5	
	26	29.59	36	1.3	1.3	100	29.64	41	3	2.5	91.5	29.69	33	0	-5	90.5	9	8.5	9.3 11.2
	27	29.74	33	.5	0	90	29.72	35	1.3	.5	86.7	29.70	31.5	-8	-1.1		10	9.5	9.3 11.2
	28	29.57	34	-1.5	-8		29.48	35	.5	0	90	29.32	34	1	-5	90.5	9	8.5	9.3 8
	29	29.34	37	.2	0	96	29.44	38	1.3	+5	88.5	29.50	32	-2	-15		7.8	7	92.5 9 9.3 8
	30	29.53	37.5	2.2	1.5	87.5	29.53	34	1.5	.5	81.7	29.54	33	0	0	100	7	6.5	92.5 8 9.3 8
	31	29.65	35.5	.5	.5	100	29.68	34	.5	.2	29.70	33	-15	-5	100	6.5	6	92.5 11.5 9.4	
	AVERAGE	29.65	37.4	2	1.5	92.8	29.64	40.1	4.6	3.4	80.9	29.63	35	1	0.76	90.1	8.9	8.5	94.1 9.4

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morn. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in. Same instruments to be used in all hygrometric observations.

January, for the month of July, 1880.

AVERAGE NUMBER OF SHIP'S COMPANY.

AVERAGE NUMBER OF SHIP'S COMPANY.							REMARKS.
10 P. M.	No.						
Dry bulb.	Wet bulb.	Relative humidity.	WIND.	WEATHER.	Carbonic acid corrected for Temperature and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.	
98 9.8 9 87.5 02	bc					1	Both decks dry -
99 13 12.5 94	0	bc				1	" " "
98 10.2 10 97	clear	bc				1	Both decks washed down
94 13 12.5 94	NE/N	0F.				1	" " dry -
94 13.2 13 98	E	OC				1	" " "
90 11.5 15.5 94.5	E	OC R				1	Open .. damp. Rain. B.D. dry -
13.2 13 98	SE/S	OC R				1	" " " " "
96 11.5 11 94	NW	bc				1	Both deck dry -
98 10.2 10 97	NW/W	bc				1	" " "
90 12 12 100	SW/N	OC Rain			BD 10 P.M.	1	Open deck washed up. B deck washed.
94 15 14 89	E	OC				1	Both deck dry -
98 12 11.5 94	E	bc				1	" " "
98 11.5 11 94	NE/E	bc				1	" " "
86 11.2 16 97	W	OC F				1	Open deck damp. B deck dry -
94 10.2 10 97	SW/W	bc - R.P.M.				1	Wet from rain.
96 10 9.5 93	W/N	bc				1	Open deck damp. R at night. B.D. dry -
97 15 14 89	SE	OC R P.M.					Open deck washed down. B.D. washed -
94 13.5 13 94	W/N	OC S.P.M. 2708			BD 10 P.M.	1	Both decks Damps -
97 12.5 12 94	"	OC M				1	" " dry -
94 12 11.5 94	E, NE	OC				1	A Deck. wet rain. B.D. dry -
97 11 10.5 93.5	W/P	OC M				1	" " " " " "
92.5 9.5 9 93.5	W	OC A				1	A " " " melting snow. " " "
93 10.5 10 94	W/N	bc				1	" " " " " "
99 14.8 14 91	W/P	OC				1	A deck dry B.D. washed down
92.5 11 10.5 93.5	W	OC A P.M.				1	" " " melting snow B.D. dry -
97 12.2 12 98	SW/W	OC	3.48			1	B deck. 10 P.M.
97 12.2 12 98	W	OC				1	" " " " "
93 10.2 10 97	W/P	OC				1	" " dry " "
93 9 8.5 93	S/W	bc				1	" " damp " "
93 8.5 8 92.5	S/W	OC, R.P.M. B.D. 10 P.M.				1	B.D. wet from melting snow -
94 10.5 10 94	SW/W	bc. P	2.088			1	Both decks washed.
93 11.7 11.2 94.3	Southw.	OC	2.637			1	wet

should be selected. The results will not be entered unless the observer is certain of their accuracy.

J. M. Amble
R.A. Surgeon, U. S. N.

July 1867

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new pithos very bad
below water

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.
India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkoffer's method is to be followed. For those not familiar with it the following

process, extracted from Wilson's Hand-Book of Hygiene, is recommended:
The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent, to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

$$30 : \text{observed height of bar.} :: \text{capacity} : z.$$

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Arctic*

BERTH

SPAR DECK.

PLACE.	DATE.	10 A. M.				4 P. M.				10 P. M.				10 A. M.			
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.
<i>In the pack</i>	1 29.66 39.5 3 2.5 91.5 29.60 38 2.5 2 91 29.60 33 -5 0 90	6.5	6	92.5	9.5	45.95				6.5	6	92.5	9.5	45.95			
	2 29.61 35° .5 0 90 29.62 38 3 2 81 29.62 29.5 -2 -2	5	4.5	92.6	5	4.5	92.6	5	4.5	5	4.5	92.6	5	4.5	92.6	5	4.5
	3 29.64 32 -0.5 -0.5 100 29.22 35° 1.1 1.1 100 29.21 34.5 -8 1.8 100	6	5.5	92.5	7	6.5	92.5	7	5.5	6	5.5	92.5	7	6.5	92.5	7	6.5
	4 29.16 35° 10.5 11.5 100 29.30 37 +2 +1.5 91 29.22 31 -1 -1.5 100	6.5	6	92.5	8.5	43.9				6.5	6	92.5	8.5	43.9			
	5 29.43 35 .5 0 90 29.47 33 0 -5 90.5 29.52 31 -1.8 -1	7	6.5	92.5	9.5	43.5				7	6.5	92.5	9.5	43.5			
	6 29.57 35 0 0 29.60 37 1.8 1.6 29.59 32 -2 -8	8	7.5	93	9	83.9				8	7.5	93	9	83.9			
	7 29.52 37 1.5 1 91 29.58 35° .8 -8 100 29.74 35 -0.5 -0.5 100	6.2	6	97	15	44.15				6.2	6	97	15	44.15			
	8 29.94 36 0 -1.5 90.5 29.99 36 -0.2 -0.8 29.99 29 3.06 -3.06	8	7	86	9	23.10				8	7	86	9	23.10			
	9 29.72 30 -1 1.5 90 29.84 36 0 -5 90.5 29.79 31 -1.11 -1.11 100	7.2	7	97	9.5	45.11				7.2	7	97	9.5	45.11			
	10 29.68 35° .8 .5 29.65 38 1.5 .5 81.7 29.63 35 -0.2 -0.2 100 10 9.5 93 12.5	14.12															
	11 29.76 41 0 -0.2 29.73 39 2 1 82 29.70 35° 1 2.5 90.5 8.5 8 93 10.2 17.11																
	12 29.74 40 1.5 1 91 29.88 35° 1.3 1 94.5 29.98 29.5 -1.5 -2 90.5 5.5 5 92.5 7 6.5																
	13 30.07 41 -0.5 -1 90.5 30.08 42 3 2 83 30.04 35° 0.5 0 90 6.2 5.5 8.5 8.2 97.3																
	14 29.90 37.5 1.3 1.3 1.3 29.84 38 1.1 1.1 90.5 29.88 35° 0.8 0.8 100 10 10 100 19 15.19																
	15 29.88 39 2.2 2.2 100 29.82 39 3 2.5 91.5 29.83 35° 1.1 1.1 100 9.5 9 93.5 12.2 18.11																
	16 29.82 37 1.5 1.5 100 29.81 35° 1 1 100 29.83 3.05 0.5 0.5 100 8.2 8 17 8.5 8.5 11																
	17 29.78 36 1 1 100 29.73 36 1.3 1.3 100 29.72 34.5 0.5 0.5 100 9 8.5 93 10.2 17.11																
	18 29.78 41 3.3 3.3 100 29.80 36 1.3 1.3 100														10	11.12	
	19 29.82 42 3.3 3 9.5 29.84 42 3.5 3.3 29.86 37 1.5 1.5 100 10 9.5 93 11 15.10																
	20 29.94 45 2.5 2 91 29.95 45 4.8 3.8 29.95 38 1.1 1.1 100 10.2 10 9.7 11 15.5																
	21 30.00 44.5 2.7 2.7 100 30.01 4.0 2.5 2.5 100 30.06 36 1.1 1.1 100 4.5 11.5 100 14 10.1																
	22 30.14 36 0.8 0.8 100 30.17 36 1.3 1.3 100 30.18 3.5 0.8 0.8 100 9 8.5 93 11.2 17.12																
	23 30.16 36.5 1.3 1.3 100 30.12 39 2.5 2.5 100 30.10 36 1.1 1.1 100 10 9.5 9.3 11 15.11																
	24 30.04 38 2.5 2 91 30.02 39 2.5 2 91 30.01 35° 1.1 1.1 1.1 100 11 10.5 93.5 11.2 17.12																
	25 30.04 36.5 1.5 1 91 30.05 35° 1 0.5 90.5 30.06 34 0.2 0.2 0.2 100 10.5 10 9.4 9.5 15.11																
	26 30.03 35 0.8 0.8 100 29.99 35° 1.1 1.1 100 29.98 35° 0.8 0.8 100 10.2 10 9.7 11 1.1																
	27 29.92 34 1.8 1.8 100 29.86 37 1.3 1.0 94 29.82 35° 1.0 0.5 90.5 9 9 100 18 15.20																
	28 29.81 36 1.5 1.5 100 29.84 38 1.5 1.5 100 29.80 34 0.2 0.2 100 10.5 10 9.4 12.5 1.4 11.12																
	29 29.98 36 0.8 0.5 91 29.99 36 1.5 1.5 100 30.00 34 0.5 0.5 100 12 11.5 94 16 14.16																
	30 29.96 35 0.5 0.5 100 29.94 36 1.1 0.8 29.90 32 -1.1 -1.1 100 11 10 87 13 14.13																
	31 29.88 67 1.8 1.4 94.5 29.82 41 3.0 2.5 91 29.78 32 1.0 -1.0 1.0 95 9 93.5 9.5 15.11																
AVERAGE	29.794 38 1.3 1.1 96.5 29.84 37.4 1.6 1.8 94 29.82 34.3 8.1 0.4 98 8.8.2 97.2 10.9 11.11																

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morn. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in. Same instruments to be used in all hygrometric observations.

Jannette

, for the month of August, 1880.

BERG DECK.		AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.
P. M.	10 P. M.	No.	WIND.	WEATHER.	Relative humidity.	
Dry bulb.	Dry bulb.					
Wet bulb.	Wet bulb.					
Relative humidity.	Relative humidity.					
95° 7 93.5 95° 9 93.5 N 0.0 N	10 P.M.	1	Spardick wet. Both deck dry.			
65° 6 92.5 7 6.5 92.5 W/N 0.0 N	10 P.M.	1	" " dry			
7 65 92.5 7.5 7 93 91.5 0.0 S	10 P.M.	1	" " wet			
85° 8 93 9 8.5 93 WSW 0.0 Y	10 P.M.	1	" " "			
95° 9 93.5 10.5 10 94 10 W 0.0 S	10 P.M.	1	Both deck dry.			
9 95 93.5 9.5 9 93.5 N 0.0 1.959	10 P.M.	1	" "			
15 83.5 10.5 12.5 88.5 N 0.0 R P.M.	10 P.M.	1	Open deck untroubl. B. d. washed up			
9 85 93 10 9.5 98 NW/N 0.0, mist	10 P.M.	1	" damp" " dry			
95° 93.5 11 10.5 93.5 N E 0.0 R P.M.	10 P.M.	1	" dry, am.			
12.5 2 94 12.5 12 94 N 0.0 R, mist	10 P.M.	1	" wet			
10.2 4 97 11.5 11 94 N 0.0	10 P.M.	1	" damp			
87 5 92.5 9 8.5 93 WSW 0.0 E, 8 P.M.	10 P.M.	1	" dry			
5 82.8 97 30.5 10 94 88.2 0.0 C	10 P.M.	1	" "			
0 19 89.5 15.5 15 94 NNE 0.0, mist R	10 P.M.	1	Both decks washed up			
18.2 6 98.5 11.2 11 97 NNE 0.0 " "	10 P.M.	1	B. d. wet			
85° 93.5 11 11 100 NNE 0.0 C M R	10 P.M.	1	" " "			
18.2 0 97 11.2 11 97 21/2 0.0 C	10 P.M.	1	" " "			
10 0 100 12 12 100 C M 0.0 F	10 P.M.	1	" " "			
11 95 93.5 10.5 10.5 100 C M 0.0 C	10 P.M.	1	" dry			
11 0.5 93.5 12.5 12.5 100 0.0 C 0.0 C	10 P.M.	1	" " "			
0 14 100 14 13.5 94.5 N/W 0.0 C	10 P.M.	1	Both decks washed up			
3 11 1 97 12.2 12 97 C M 0.0 F	10 P.M.	1	Wet down 8 am			
36.1 1 95 93.5 11.5 11 94 NNE 0.0 F	10 P.M.	1	" damp			
35.11 1 97 12.2 12 97 NNE 0.0 C M	10 P.M.	1	B. d. wet. B. d. damp			
4 95° 98.5 11.5 11.5 100 NNE 0.0 C M	10 P.M.	1	B. d. damp			
2 11 100 11 11 100 NNE 0.0 C M	10 P.M.	1	" " "			
0 18 105 20 185 86 NNE 0.0 C M F	10 P.M.	1	B. d. wet			
4 12.5 94 14 13.5 94.5 NNE 0.0 C F	10 P.M.	1	Both decks washed up			
4 11 158.4 165 15 84 88.2 0.0 C F	10 P.M.	1	B. d. damp. B. d. damp			
7 13 88.13 12.5 94 88.2 0.0 C F M	10 P.M.	1	" art			
2 18.5 93.5 10.5 10 94 " F C	10 P.M.	1	Art melting ice. B. d. dry			
2 18.5 96.11.6 11.2 94.5 Northly cloudy	10 P.M.	1	Spardick wet. B. d. damp			

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.
in the column of Remarks.

Aug 1881

101

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkof's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .35748+.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°. The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S.

Arctic Star Jr.

BERT

SPAR DECK.

PLACE.	DATE.	10 A. M.						4 P. M.						10 P. M.							
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.		
In the pack	1	29.72	58	25 1.5	82	29.74	34	0.8	0.8	100	29.74	82	-1.0	-1.5	80	8.5	8	93	8.5		
73° 52' N Lat 174° 48' W Long	2	29.68	37	0.5	0.5	100	29.69	33	-0.5	-0.5	100	29.73	30	-1.5	-1.5	100	9.5	9	93.5	8.0	
73° 41' N Lat 177° 12' W Long	3	29.84	36.5	0.2	-0.2		29.86	47	-0.5	-0.8		29.86	49.5	0.0	-0.5	90.5	7.5	7	92.5	7.5	
73° 40' 15" N Lat 176° 55' 30" W Long	4	29.92	49	-0.5	-0.5	100	29.93	53	-1.0	-1.5	90	29.91	57.5	-2.5	-2.8		8.0	7.5	93	18.5	
73° 40' 30" N Lat 176° 30' 40" W Long	5	29.90	61	-1.5	-2.0	90	29.90	47	-1.0	-1.5	90	29.94	48.5	-2.0	-2.5	74	7.0	6.5	92.5	11.0	
73° 36' N Lat 176° 42' W Long	6	30.01	48.5	-1.0	-2.0	80	30.01	47.5	-1.0	-1.0	100	29.96	47	-6.0	-6.0		9.0	8.0	86	8.0	
73° 30' N Lat 176° 33' W Long	7	29.93	45.5	-1.0	-1.5	90	30.05	44.5	-3.8	-3.8	100	30.17	54.5	-6.0	-6.0		6.5	6.0	92.5	13.0	
73° 31' 45" N Lat 176° 37' 15" W Long	8	30.08	47.5	-4.4	-6.0	20	29.95	44	-4.4			29.84	52	-4.4			5.5	5.0	92.5	12.0	
73° 31' 45" N Lat 176° 37' 15" W Long	9	29.70	47.5	-0.2	-0.2	100	29.68	47	+0.8	+0.8	100	29.72	50	0.0	0.0	100	9.2	9.0	92.0	10.0	
73° 31' 45" N Lat 176° 37' 15" W Long	10	29.76	47	0.0	-0.2		29.88	47	+0.2	0.0	96	29.98	48	-5.2			9.5	9.0	92.5	10.0	
73° 31' 45" N Lat 176° 37' 15" W Long	11	29.82	45.5	-1.5	-2.0	90	29.76	45.5	+0.5	+0.0	90	29.78	56	-0.5	-0.5	100	8.0	7.5	92.5	11.5	
73° 40' 30" N Lat 176° 30' 40" W Long	12	29.72	50.5	-0.2	-0.2	100	29.63	51	0.0	-0.2		29.54	50.5	-1.5	-1.5	100	7.8	7.0	89	11.2	
73° 36' N Lat 176° 30' 40" W Long	13	29.45	47.5	-1.3	-1.3	100	29.46	46	-0.8	-1.0	96	29.49	48	-4.4	-4.7		8.5	8.5	100	9.0	
73° 36' N Lat 176° 42' W Long	14	29.47	44.5	-5.5	-6.0	87.5	29.45	44.5	-4.3	-4.7		29.37	44.5	-8.8			7.0	6.5	92.5	7.5	
73° 30' N Lat 176° 33' W Long	15	29.16	40.0	-6.0			29.28	47.0	-7.5			29.45	51.5	-11.0			6.0	5.5	92.5	13.5	
73° 30' N Lat 176° 33' W Long	16	29.55	48	-10.0			29.58	48	-9.4			29.63	50.5	-12.0			9.0	7.5	79.5	15.5	
73° 25' N Lat 176° 37' W Long	17	29.69	49	-12			29.65	51	-8.5			29.57	54	-9.5			9.0	8.5	92	18.5	
73° 25' N Lat 176° 37' W Long	18	29.46	59	-7	-7.5	86.5	29.42	52	-6.0	-6.3		29.55	55	-13.5			7.0	6.5	92.5	16	
73° 31' N Lat 176° 36' W Long	19	29.77	55	-7			29.83	56	-7.0			29.85	57	-8.5			7.0	6.5	92.5	8	
73° 31' N Lat 176° 36' W Long	20	29.92	54	-7.7			29.95	53	-8.0			29.94	56.5	9.5			11.5	10.5	87.2	15	
73° 24' 30" N Lat 176° 33' 40" W Long	21	30.05	53	-10.0			30.06	52.5	-11.0			30.05	54.5	-15.0			12	10.5	82	14.5	
73° 25' N Lat 176° 37' W Long	22	30.03	52.5	-10			30.03	49.5	-7.5			30.06	54.5	-6.5			11	9.5	82	12.5	
73° 25' N Lat 176° 37' W Long	23	30.07	52.5	-4.5			30.05	54	-6.5			30.02	54.5	-8.5			12	11.0	88	18	
73° 31' 15" N Lat 176° 40' 15" W Long	24	29.98	57	-9.5			29.93	49	-7			29.92	55	-8.5			10.5	9.5	87.5	10	
73° 31' 15" N Lat 176° 40' 15" W Long	25	29.93	53.5	-5.5			29.68	54.5	-7			29.56	54.5	-5.5			7.5	7	92.5	13	
73° 25' N Lat 176° 37' W Long	26	29.67	54	-4.4			29.76	52	-0.8			29.74	55	-7.0			10	9.5	93	14.5	
73° 25' N Lat 176° 37' W Long	27	29.91	54.5	-7.5			29.91	53.5	-4.5			29.95	55	-7.0			11.5	10.5	87.2	14.5	
73° 25' N Lat 176° 37' W Long	28	30.04	55	-3			30.03	53.5	-3.5			30.04	57	-5			7	6.5	92.5	10	
73° 25' N Lat 176° 37' W Long	29	30.08	54	-10.5			30.06	53	-11.5			30.08	56.5	-10.5			7.5	6.5	85.5	10	
73° 25' N Lat 176° 37' W Long	30	30.03	53	-7.5			30.00	49	-15			30.02	55	-15.5			5	4	84	9.5	
	31	2																			
AVERAGE			29.76	49.6	-4.7	-1.7	87	29.80	48.7	-4.6	-1.5	95	29.82	51.5	6.4	-2.4	92.2	8.4	7.7	90.4	11.4

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks *from any cause* will be entered in the log. Same instruments to be used in all hygrometric observations.

Gammonette

, for the month of Sept 1880.

BERTH DECK.		AVERAGE NUMBER OF SHIP'S COMPANY.					REMARKS.		
10 P. M.	No.	WIND.	WEATHER.	Dry bulb.	Wet bulb.	Relative humidity.	Relative humidity.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.
85.8	93 10.5 10. 94	clm	bc					1	Spar deck damp. Both deck dry.
86.0	93 10.0 9.5 93 18	ocs						1	" " wet " " damp
86.7	98.5 11.0 10.5 93.5 N	ocs						1	" " " " "
86.5	90 15.0 14.5 94.5 N	0c.8						1	Both decks washed up.
86.5	93.5 12.0 11.5 94.0 N/W	bc. S. P.M.	1.63					1	" damp.
86.8	93 9.0 8.5 93.0 N	0c be S						1	Spar deck damp. Condensation on beams ¹ Both deck.
86.8	88 14 13.5 94.5 N	bc. S.						1	" melting snow. B. D. damp.
86.8	87 12 11.5 94.0 S. S. E	bc						1	Snow on Spar deck. " " "
86.8	93 12.5 12.5 100.0 SSW	0cf. R.						1	Spar deck wet rain "
86.8	93 12. 12 100 NNEW	bc-S						1	" " melting snow " "
86.8	95 12.5 12.5 100 SW	0c. R. S.						1	" " " " " Both deck washed.
86.8	97 13.0 12.5 94.3 S	"f. R. S.						1	" " " " damp.
86.8	93 11.0 10.5 93.5 SW	bc						1	Both decks damp
86.8	92.5 10.0 9.5 93.0 WSW	bc						1	" " dry
86.8	88.5 12.0 11.5 94.0 N/E/W	ocs						1	Snow on Spar deck. Both dry.
86.8	94.5 13.5 12.5 88.5 N/W	bc						1	Both decks dry.
86.8	88.5 13.5 12.5 88.5 SW	bc						1	Spar deck dry. Both deck damp. condensation.
86.8	89 14. 13 89 SW	bc						1	" " " " washed.
86.8	93 9.5 9. 93.5 WSW	bc						1	Both dry.
86.8	88.5 14.5 13.5 88.5 N/E	0c						1	Spar deck dry. B. deck damp.
86.8	88 14. 13 89 N.W	bc						1	Both dry.
86.8	88.5 13.5 12.5 88.5 clm	bc						1	" "
86.8	88 14. 12.5 83.5 N.E	0c						1	" "
86.8	93 13.5 11.5 86. E	0c						1	" "
86.8	94 15.5 14 84 91. N.E	0c						1	Snow on Spar deck. Both deck washed up.
86.8	79 15. 14 89 E	0c						1	" dry.
86.8	88 16 14 89 91.2	0c						1	" "
86.8	86 12 11 88 84.8	0c						1	" "
86.8	86 18.5 12 85.5 91.8	0c						1	" "
86.8	73 10.5 9 81 NNE	0c						1	" "
86.8	88.9 12.5 11.4 91.2	various	19.02	11.62	2.519	1			dry damp

ing should be selected. The results will not be entered unless the observer is certain of their accuracy.

ill be entered in the column of Remarks.

150 31 00 68 6.00
250 9 00 68 6.00
350 20 00 68 6.00
450 30 00 68 6.00
550 40 00 68 6.00
650 50 00 68 6.00
750 60 00 68 6.00
850 70 00 68 6.00
950 80 00 68 6.00
1050 90 00 68 6.00
1150 100 00 68 6.00
1250 110 00 68 6.00
1350 120 00 68 6.00
1450 130 00 68 6.00
1550 140 00 68 6.00
1650 150 00 68 6.00
1750 160 00 68 6.00
1850 170 00 68 6.00
1950 180 00 68 6.00
2050 190 00 68 6.00
2150 200 00 68 6.00
2250 210 00 68 6.00
2350 220 00 68 6.00
2450 230 00 68 6.00
2550 240 00 68 6.00
2650 250 00 68 6.00
2750 260 00 68 6.00
2850 270 00 68 6.00
2950 280 00 68 6.00
3050 290 00 68 6.00
3150 300 00 68 6.00
3250 310 00 68 6.00
3350 320 00 68 6.00
3450 330 00 68 6.00
3550 340 00 68 6.00
3650 350 00 68 6.00
3750 360 00 68 6.00
3850 370 00 68 6.00
3950 380 00 68 6.00
4050 390 00 68 6.00
4150 400 00 68 6.00
4250 410 00 68 6.00
4350 420 00 68 6.00
4450 430 00 68 6.00
4550 440 00 68 6.00
4650 450 00 68 6.00
4750 460 00 68 6.00
4850 470 00 68 6.00
4950 480 00 68 6.00
5050 490 00 68 6.00
5150 500 00 68 6.00
5250 510 00 68 6.00
5350 520 00 68 6.00
5450 530 00 68 6.00
5550 540 00 68 6.00
5650 550 00 68 6.00
5750 560 00 68 6.00
5850 570 00 68 6.00
5950 580 00 68 6.00
6050 590 00 68 6.00
6150 600 00 68 6.00
6250 610 00 68 6.00
6350 620 00 68 6.00
6450 630 00 68 6.00
6550 640 00 68 6.00
6650 650 00 68 6.00
6750 660 00 68 6.00
6850 670 00 68 6.00
6950 680 00 68 6.00
7050 690 00 68 6.00
7150 700 00 68 6.00
7250 710 00 68 6.00
7350 720 00 68 6.00
7450 730 00 68 6.00
7550 740 00 68 6.00
7650 750 00 68 6.00
7750 760 00 68 6.00
7850 770 00 68 6.00
7950 780 00 68 6.00
8050 790 00 68 6.00
8150 800 00 68 6.00
8250 810 00 68 6.00
8350 820 00 68 6.00
8450 830 00 68 6.00
8550 840 00 68 6.00
8650 850 00 68 6.00
8750 860 00 68 6.00
8850 870 00 68 6.00
8950 880 00 68 6.00
9050 890 00 68 6.00
9150 900 00 68 6.00
9250 910 00 68 6.00
9350 920 00 68 6.00
9450 930 00 68 6.00
9550 940 00 68 6.00
9650 950 00 68 6.00
9750 960 00 68 6.00
9850 970 00 68 6.00
9950 980 00 68 6.00
10050 990 00 68 6.00

Sept 1880

14

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by .795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent, to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°. The formula for the correction for pressure is as follows:

30 : observed height of bar : : capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Arctic* *St. Jde*

PLACE.	DATE.	SPAR DECK.				BERTH			
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.
1	29.86 49-11.1	29.78	47-8.3			29.73	56-6.5		
2	29.67 54.5-7.2	29.66	50.5-6.5			29.72	55-7.5		
3	29.90 53.5-12.2	29.99	53.5-10.5			30.06	56-15.5		
4	30.16 49-11.3	30.12	53-13.5			30.23	56-16.5		
5	30.24 50-15.5	30.25	49-12.2			30.27	53-11.5		
6	30.30 50-10.5	30.30	50-10.5			30.38	53-10.		
7	30.35 54-9.1	30.32	50-9.5			30.30	53-11		
8	30.15 49.5-11.	30.11	51-11.			30.11	52-11.5		
9	30.07 49-11.5	30.05	51-11.8			30.07	56-11		
10	30.08 52.5-11	30.09	52-11.5			30.10	53-11.5		
11	30.08 55-12.2	30.07	50-10.8			30.10	55-11.1		
12	30.11 52-11	30.14	50-12.5			30.15	58-12.8		
13	30.21 50-12.5	30.22	51-11.5			30.25	55-12.5		
14	30.19 50-14.4	30.16	46-12.7			30.13	50-8.8		
15	30.23 51-6.5	30.28	49-7.2			30.30	53-12.2		
16	30.30 53-12.5	30.30	47-20.0			30.35	53-20.5		
17	30.44 52-22.7	30.40	44-22.2			30.39	52-24.4		
18	30.27 48-17.7	30.25	48-15			30.24	53-13.8		
19	30.24 53-13.5	30.24	53-15			30.13	53-16.5		
20	30.00 52.5-12.7	29.88	55-10.5			29.79	53-9.4		
21	29.88 56-12.7	30.00	55-12.2			30.19	57-10.5		
22	30.38 57-11.6	30.41	53-11.6			30.49	53-11.5		
23	30.68 52-18.8	30.72	52-21.1			30.73	53-18.5		
24	30.55 56-15	30.42	51-15			30.30	52-14.4		
25	30.10 49-22.5	30.02	43-21.5			30.00	50-22.2		
26	30.51 54-20.5	30.07	46-22.2			30.15	53-20.5		
27	30.26 47-18.8	30.35	57-18.3			30.42	52-17.7		
28	30.57 53-16.5	30.60	50-20.5			30.59	52-19.4		
29	30.58 51-20.5	30.59	49-23.8			30.69	52-25.5		
30	30.71 47.5-28.5	30.73	52-21.6			30.70	53.5-23.3		
31	30.62 49.5-23.3	30.57	52-22.2			30.50	51-18.3		
AVERAGE		30.23	51.2-15			30.22	50-14.5		
						30.24	53.7-15.5		
								7.7	5.9 78.7 11.7 10.3

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morn. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Hammond

, for the month of

October

1880

BERTE DECK.		AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.	
10 P. M.	No.	WIND.	WEATHER.	Dry bulb.	Wet bulb.	Relative humidity.	Relative humidity.
23/10 12 13.5 12.5	90.5	nnw	oc				
23/10 83 14 13	89	ne	bc				
23/10 86 10 9.5	93	sww	bc	1.017	1		
23/10 80 11 9.5	81	..	oc				
23/10 79.5 10.5 9	81	wnw	bc				
23/10 78 10.5 9.5	86.2	n	oc				
23/10 85 11 10	87	n	oc				
23/10 82 14.5 13	13	nnw	oc				
23/10 85.5 14.5 13	83	..	bc				
23/10 88.15 13 7.8	2	oc	1.028	1			
23/10 88 11 10	87	clw	oc				
23/10 87 10 9	86	e	oc				
23/10 75 12 11	88	e	oc				
23/10 82 11 10	87	sww	oc				
23/10 85 10 9	86	nnw	bc				
23/10 82 7.5 6.5	86	w/w	bc	1.9069	1		
23/10 86 12 12	88	sww	oc				
23/10 81 11 10	87	sw/e	bc				
23/10 76.5 10.5 9	81.5	8/10	oc				
23/10 82 18 12	88	w	oc				
23/10 85.5 14 13	89	sww	oc				
23/10 78 14.5 13	83	nnw	bc				
23/10 82 10 8.5	80	8/10	bc				
23/10 87 9 7	73	0e	bc	9158	1		
23/10 87 9 8	86	8/11	bc				
23/10 87 11.5 9	72	nnw	bc				
23/10 78 16.5 10.5	81.5	"	"				
23/10 77 10 8	74	"	"				
23/10 82 11 9.5	81	nnw	"				
23/10 86 11.5 10	81.5	82/3	"				
23/10 82 11.5 10.2	83.8	w/w	bc	1.9921	1		

The results will not be entered unless the observer is certain of their accuracy.

and in Remarks.

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Mar 1880

16

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following

process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°. The formula for the correction for pressure is as follows:

$$30 : \text{observed height of bar.} : \text{capacity} : z$$

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. *Arctic*

BERTH

SPAR DECK.

PLACE.	DATE.	10 A. M.	4 P. M.	10 P. M.	10 A. M.
		Barometer. Attached Thermometer. Dry bulb.	Barometer. Attached Thermometer. Dry bulb.	Barometer. Attached Thermometer. Dry bulb.	Barometer. Attached Thermometer. Dry bulb.
1	30.38 54-18.3	30.37 53-16.6	30.39 55-14.4	12.10 76 12.5 1.5	
2	30.2650-15.	30.15 51-12.5	30.18 56-16.1	16.13 69 12 1.5	
3	30.34 51-19.4	30.38 50-20.5	30.38 51.5-26.1	17.15585-15.5 1.5	
4	30.04 45-13.3	29.89 46-17.3	29.80 53-12.5	15.12 66 14.5 1.5	
5	29.77 50-22.2	29.80 48-22.3	29.88 53-28.8	16.14.5 84 15 1.5	
6	29.92 51-29.4	29.93 44-31.1	30.00 52-29.4	17.12 7.8 12 8.2	
7	30.02 43-30.5	30.05 45-29.4	30.15 51-30.5	11.9 75-11.5 1.5	
8	30.20 43-28.8	30.19 44-28.4	30.20 48-27.7	11.5 9 81 9.5 8.0	
9	30.09 48-27.2	30.05 49-26.1	30.12 53-24.4	13.5 11 72 11.5 1.5	
10	29.83 49.5-25.	29.78 48-26.1	29.77 51-26.1	13.11 77 12 1.5	
11	29.70 47-27.7	29.67 46-28.5	29.65 57-28.5	13.5 11 72 10 8.5	
12	29.57 45-28.8	29.46 44-30.	29.50 53-27.7	8.5 7 80 9.5 10.5	
13	29.69 49-24.6	29.75 49.5-24	29.79 54-23.5	10.8 74 9 7.5	
14	29.70 50-24.4	29.90 49-27.7	30.03 51-28.4	11.9 75-12 8.2	
15	30.45 49-27.7	30.64 46-27.7	30.92 50-29.4	13.5 11 72 10 1.5	
16	31.11 50-29.4	31.05 46-28.3	30.95 51-25.5	7.6 85-9.5 1.5	
17	30.4850-16.6	30.29 54-14.4	30.18 58-12.7	9.8 86 10 1.5	
18	29.93 60-14.4	29.80 58-13.3	29.70 57-13.3	12.10 76 13.5 1.5	
19	29.67 60-13.3	29.48 55.5-13.8	29.80 56-17.7	10.5 10 82 15 1.5	
20	29.93 56-16.1	30.00 55-18.8	30.09 60-18.3	13.11 77 15.5 1.5	
21	30.25 61-18.0	30.20 57-18.0	30.28 59-15.5	14.11.5 70.5-13.5 1.5	
22	30.23 55.5-21.6	30.20 52-23.3	30.20 58-20.5	11.9 75-10.5 1.5	
23	30.19 54-23.3	30.17 53-23.8	30.20 54-23.3	17.9 75-10 1.5	
24	30.27 65-22.7	30.30 56-26.1	30.36 54-24.4	14.5 12 73 12.5 1.5	
25	30.84 60-21.6	30.33 54-26.1	30.29 55-23.3	11.5 10 82 10 1.5	
26	30.14 63-23.8	30.04 50-21.6	30.15 52.5-19.4	14.12 78 14.5 1.5	
27	30.01 59-19.4	29.97 55-17.1	29.95 61-17.1	14.14 79 14 1.5	
28	30.96 60-18.3	29.94 49-18.8	30.03 61.5-20	15.5 13 74 14.5 1.5	
29	30.24 60-20	30.20 56-20	30.02 57-17.7	12.5 10 71 13 1.5	
30	29.60 57-6.4	29.58 63-6.4	29.66 61-6.1	14.5 12 73 16 1.5	
31					
AVERAGE		30.10 52-21.5	30.06 50.9-24.9	30.07 55-21.7	12.7 10.6 76.5 12.2 1.5

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Jannette

, for the month of November, 1880.

BERTH DECK.	AVERAGE NUMBER OF SHIP'S COMPANY.							REMARKS.
	4 A. M.	10 A. M.	No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.	
145	76.5	14	12 78	N	bc	1.5706	1	Both decks dry -
12	76	135	12 83	WNW	OCN	1	"	"
155	74	13	11.5 82.5	WNW	bc	1	"	"
145	73	14	12 79	WNW	OCN	1	"	"
15	78	12	10.5 82	WNW	bc	1	"	"
12	10.5 82	11.5	10 82	"	bc	1	"	"
115	95 85	12	10 76	WNW	bc	1	"	"
95	8	80	10 9	86 112	bc	1.069	1	"
115	9	81	12 10 82	82	bc	1	"	"
12	76	11	10 87	NNN	bc	1	"	"
10	85 85	12	11 88	N	bc	1	"	"
95	7.605	10	85 80	N	bc	1	"	"
9	73	9	8 86	NE	bc	1	"	"
11	10.5 82	135	12 83	SWW	bc	1	"	"
10	74	11	10 87	SWW	bc	1	"	"
95	85 86.5	10	9 86 112	bc	1	"	"	"
10	86	11	9 75	2	OC	1	"	"
135	10.5 82.5	12	10.5 82	E/N	OC	1	"	"
15	66	14.5	18 83	W/N	OC	1.884	1	"
155	74	12	10.5 82	WNW	bc	1	"	"
15	82.5	12	12 88	N	bc	1	"	"
10	80.5	13	12 89	NNW	bc	2.018	1	"
11	74	13	11 77	NWN	bc	1	"	"
12	76	11.5	10 82	SW	bc	1	"	"
10	8	74	11.5 10 82	2	bc	1	"	"
145	73	13	11.5 82.5	N	bc	1	"	"
14	78	14	12.5 73	N	bc	1	"	"
145	78	12	10.5 82	N/E	bc	1	"	"
13	77	14	12 79	ENE	bc	1	"	"
14	79	14.5	15 84	NE/1	bc	3.0803	1	Open deck atmosphere in deck house
145	77.5	12.5	10.8 79.1	W/NW	bc	1.9069 1.884 WR	1	Washed on Saturday -

in the morning should be selected. The results will not be entered unless the observer is certain of their accuracy.
entered in column of Remarks.

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Directions: Perenkofar's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0026361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

$30 : \text{observed height of bar.} :: \text{capacity} : z$
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. Arctic *Phi* *Jan*

SPAR DECK.

BER

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.			
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.
1	29.63 64-8.3				29.56 59-2.4				29.82 60-17.7				16 13.5 74 10-115	
2	29.88 53-20.5				30.03 56.5-23.3				30.10 57-22.2				11 9 75-12 111	
3	30.58 54-25.5				30.40 51.5-23.8				30.54 58-20.				11.5 9 72 11 118	
4	29.98 57-10				29.90 53-7.7				29.89 61.5-8.6				12 10 76 145 185	
Lat 74° N Long 179° 10' E Lat 73° 53' N Long 179° 10' E					30.23 57-17.2				30.44 63-22.8				15 13 78 16 115	
5	29.84 57-12.2				30.50 54-28.8				30.48 60-29.4				13 10.5 71.5 13-112	
6	30.62 58-29.4				30.00 50-23.3				29.95 61-23.3				12.5 10.5 76.5 18 118	
7	30.25 55-24.6				29.80 55-21.1				29.88 61-22.2				12.5 10 71 18.5 1511	
8	29.80 55-22.2				29.80 50-28.				29.83 61-27.7				12.5 10 71 12 16 11	
9	29.81 53-20.5				29.62 52-25.5				29.56 56-23.8				11 9 75 9 96 8	
10	29.49 55-24.4				30.19 52-30.0				30.29 53-31.6				12 10 70 10 74	
11	30.09 55-28.3				30.05 52-25.5				29.98 54-23.8				9.5 7 67.5 11 95	
12	30.03 55-28.3				29.75 54-23.3				29.73 56-23.8				13 11 77 15-170	
13	29.43 55-23.3				29.52 49-30.				30.05 55-32.7				10.5 9 81 11 25	
14	29.70 60-28.3				30.34 50-34.4				30.38 55-34.1				10 9 86 135 112 1	
15	30.37 52-33.0				30.05 52-33.3				29.96 56-32.2				13.5 11 72 12 16 1	
16	30.24 57-35.5				29.67 44.5-34.4				29.65 53-33.3				14.5 12 73 14 185 1	
17	29.75 53-38.3				29.62 49-26.6				29.69 56-21.6				8 6 72 115 125	
18	29.59 50-28.3				29.69 52 30.0				29.78 57-31.1				13 11 77 125 182	
19	29.68 54-29.4				29.85 53-28.8				29.72 54-25.5				11 9.5 81 14 183	
20	29.90 59-31.6				29.70 49-24.4				29.72 55-23.8				13.5 11.5 77 13 117	
21	29.79 58-24.4				29.89 49.5-25.5				30.06 52-23.3				13 11 77 14 185	
22	29.75 52-20.8				30.30 48-26.6				30.15 52-26.6				11 9 72 145 123	
23	30.30 52-26.6				29.90 47-18.8				30.02 56-17.7				14.5 12.5 73 12 16 1	
24	29.87 49-21.1				29.80 54-18.5				29.80 55.5-15.5				12.5 10 71 14.5 183	
25	29.75 57-12.7				29.55 53-17.7				29.54 56-23.8				15.5 13.5 77 16 144	
26	29.75 55-15.0				30.02 44-28.3				30.02 55-25.4				15 13 78 16 149	
27	30.02 44-28.3				30.20 52-32.2				30.20 52-32.2				13.5 11 72 15 18	
28	30.17 53-31.1				30.08 49-26.6				30.05 55-26.1				12 10 70 16 189	
29	30.14 50-31.4				29.60 50-18.8				29.67 52.5-22.2				11.5 9 72 11 87	
30	29.79 50-24.4				29.83 53-29.1				29.97 52.5-30.				15 13 78 14 184	
31	30.73 54-23.8												12.2 10.7 74.5 132 115	
AVERAGE ----- Lat 78° 37' N Long 179° 32' W		29.97 53.7-24.7			29.93 53.3-26.6				29.97 55.7-24.4					

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Jannette

for the month of December, 1880.

TIME. P. M.	AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.
	10 P. M.	No. 38	WIND.	WEATHER.	
74 15	69 15 13	78 ENE	bc	1	A duck with miltary in duck house
75 12	76 11	9.5 81 NW/SE	bc	1	Dry.
76 11	78 13	11.5 83.5 WNW	bc	1	dry.
76 15	87 13.5 12	83 S/E	0C	1	A. damp. B. dry -
77 14	79 15	18 18 NW/WD	0C/0	1	" "
77 13	77 12	10 74 W/P	bc	1	dry -
77 18	77 18	11.5 83.5 N	bc	2,2617	" "
77 15	77 5 11	9 75 W/P	bc	1	"
77 12	76 11	9 75.5 W/P	bc	1	"
77 11	86 8	6 85 "	bc	1	"
77 10	74 85	7 79.5 WNW	bc	1	"
77 15	75 9.5	9 93.5 WNW	bc	1	"
77 15	87 13	11.5 83.5 S/W	0C	1	"
81 11	75 13	12 88 WNW	bc	1	"
6 13	72 12.5	12 82 NW/WD	bc	1	"
72 12	76 10.5	9.5 88.5 NW/WD	bc	1	"
73 14	78 13	11 78 W	bc	2,683	"
72 15	81.5 12	10.5 85 S	bc	1	"
77 15	82 11.5	10 91.5 E/N	bc	1	"
81 11	83.5 14.5	13 83 ENE	bc	1	"
77 11	77 11	9.5 81 W/N	0C/P	1	"
77 10	87 12.5	11 82 W	0C	1	"
77 10	83 12	11 88 NW/WD	0C	1	"
70 12	88 11.5	10 87.5 N	0C	1	"
77 11	83 10	12 88 SSE	bc	1	"
77 10	84 15.2	14 87 W/N	0C	1	"
79 15	79 15-13.5	82 S	bc	2,2292	"
78 13	78 13	11.5 83.5 S/E	bc	1	"
79 13	79 13	11 78	bc	1	"
77 11	77 11	9.5 81 S/SE	bc	1	"
78 12	78 12	10 70 WNW	bc	1	"
76 12	76 12.5	10 82 WNW	bc	2,3913	dry.

in the following column should be selected. The results will not be entered unless the observer is certain of their accuracy.

6

821 828

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:
Two glass jars, cubic capacity marked in cubic centimeters.
India-rubber stoppers, and sheet india rubber to tie over necks of jars.
Glass measure graduated to 60 c. c.
One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.
A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:
30 : observed height of bar. :: capacity : z.
The result expressed by z is substituted for the actual capacity of the jar in the calculation for car-

Atmospheric Observations on board U. S. S. *Arctic*. *Arctic*. *Arctic*. *Arctic*.

SPAR DECK.

BERTE

4

PLACE.	DATE.	10 A. M.	4 P. M.	10 P. M.	10 A. M.						
		Barometer. Attached Thermometer. Dry bulb.	Wet bulb. Relative humidity.								
1	30.54 56 -16.1	30.63 58 -18.3	30.62 62 -18.8	14.5 14 76 14 178							
2	30.58 58 -18.3	30.40 53 -18.3	30.24 57 -18.0	14.5 13.5 69.5 15.5 125							
3	29.96 58 -16.4	29.82 54 -15.5	29.74 62 -15.0	15 13 78 16.5 14							
4	29.64 58 -14.4	29.48 53 -15.5	29.80 51 -21.4	14 14 79 17 14							
5	30.03 58 -30.5	30.03 54 -31.6	30.02 60 -29.4	16 18.5 73.5 15.5 13							
6	29.78 55 -25.5	29.75 55 -24.6	29.87 59 -31.1	15 13 78 13 117							
7	30.15 56 -33.8	30.20 55 -33.3	30.27 57 -31.6	12 10 78 14.5 123							
8	30.16 56 -24.4	30.11 52 -21.6	30.18 56 -18.8	12 10 78 13 117							
9	30.38 51 -18.3	30.48 52 -19.4	30.53 57 -21.1	14.5 12 73 15 123							
10	30.45 56.5 -16.1	30.38 57 -13.3	30.37 61 -12.7	17 14.5 75 16 134							
11	30.57 58 -15.0	30.63 55 -14.4	30.64 61 -13.3	14.5 14 76 13 128							
12	30.30 54 -18.8	30.30 53 -9.4	30.56 57 -12.2	17 13 78 15 128							
13	30.02 60 -17.2	31.05 58 -20.0	31.07 60 -19.4	14 14 79 14.5 123							
14	30.90 67 -17.7	30.83 57 -17.2	30.74 59 -16.1	14 11.5 72.5 14 128							
15	30.62 54 -17.7	30.60 53 -20.5	30.71 64 -21.1	17 14.5 78 -15 128							
16	30.72 58 -21.1	30.70 50 -21.1	30.78 61 -21.4	15 12.5 73 13 117							
17	30.84 54 -22.7	30.84 56 -23.3	30.85 61 -23.8	12 9.5 71.5 12 128							
18	30.87 59 -24.4	30.73 57 -25.0	30.73 62 -25.0	10.5 8.5 75 -14 128							
19	30.64 57 -24.4	30.57 57 -25.0	30.53 62 -24.4	11 9 75 14 128							
20	30.25 54 -22.7	30.15 50 -23.8	30.14 58 -23.3	13 10.5 71.5 14.5 129							
21	30.23 52 -23.3	30.29 52 -28.3	30.35 60 -28.3	10.5 8.5 75 -13 117							
22	30.25 55 -29.4	30.39 50 -31.4	30.48 67 -32.2	10 8 74 9.5 80							
23	30.49 53 -21.4	30.45 51 -31.4	30.42 57 -30.5	12 10 76 11 95							
24	30.24 53 -23.6	30.16 53.5 -19.4	30.19 58 -16.6	11 9 75 -18.5 16.5							
25	30.27 52 -18.3	30.32 53.5 -19.4	30.44 58 -21.1	14.5 12 73 12 103							
26	30.53 52 -21.1	30.60 49 -24.4	30.73 57 -26.4	12.5 10 71 13 117							
27	30.73 53 -27.7	30.62 52 -27.7	30.57 56 -28.3	13 11 77 13 117							
28	30.29 52 -24.1	30.33 51 -28.3	30.30 55 -27.2	14 13.5 73.5 14.5 134							
29											
30											
31											
AVERAGE		30.816 55 -21.7	30.38 53.7 -25.4	30.38 58 -22.4	13.9 11.6 74.9 13.3						

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Frannette

, for the month of

February

, 1881.

BERTH DECK.

Relative humidity. Dry bulb.	10 P. M.	No. 33	AVERAGE NUMBER OF SHIP'S COMPANY.				REMARKS.
			Relative humidity. Wet bulb.	WIND.	WEATHER.	Carbonic acid cor- rected for Temp. and Pressure, per 1,000 volumes.	
6 14 17 78 14.5 12.5 78 Σ	6c	1	dry.				
9 15 15 85 15 13.5 83.5 NNE	6c	1	"				
8 16.5 14 16 16 14 79 002	0cs	2.49	1				
9 17 16 74 17 15 80 NNE	0cs	1	"				
8 15 15 74 18 17.5 80	..	0cs	1	Washed B deck			
8 18 11 72 11.5 10.5 87.2 SNE	0cs	1	dry.				
7 8 15 12 78 13.5 12 83	W	0c	1	"			
7 8 15 12 78 13.5 12 83	N	0c	1	"			
7 8 15 12 78 13.5 12 83	N	0c	1	"			
7 5 16 15 74 17 15.5 85 212	6c	2.758	1	"			
7 6 15 15 78 15 13.5 83.5 002	6c	1	"				
7 8 15 15 78 15 13 82	6c	1	"				
7 5 16 15 74 17 15.5 85 212	6c	2.758	1	"			
7 6 15 15 78 15 13.5 83.5 002	6c	1	"				
7 8 15 15 78 15 13 82	6c	1	"				
7 9 15 15 78 15 13.5 78 NNE	6c	1	dry.				
7 25 15 78 15.5 13.5 79 Σ	6c	1	"				
7 8 15 15 78 15 13.5 79	6c	1	"				
7 8 15 15 78 15 13.5 79	6c	1	"				
3 15 77 18 11 77 S/N	6c	1	"				
15 10 78 18 11 72 012	6c	1	"				
7 5 15 15 78 15.5 12.5 78 N	6c	1	"				
7 5 15 15 78 15 11 9.5 81 N	6c	1	Washed B deck.				
7 15 15 79 12 10 76 8/0	6c	1.8286	1	dry.			
7 5 15 15 77 10 85 80 NW	6c	1	"				
7 4 15 15 70 10 9 86 942	6c	1	"				
7 5 15 15 75 12 88 7 Σ	6c	1	"				
7 5 15 15 76.5 13.5 12 83 SNE	0cg	1	"				
7 5 15 15 78 15 13 78 S/N	0cg	1.2446	1	"			
7 5 15 15 77 13.5 12 83 S/N	0cg	1	Washed B deck				
7 5 15 15 77 13.5 12 83 N	6c	1	"				
7 5 15 15 78 16.5 15.5 89.5 N	6c	1	"				
7 6 15 13.5 12 81 3 NNE	6c 24	2.0803	1	Bath clock went in stand by.			
0 0 0 0 0 0 0 0	0cs 9						

The results will not be entered unless the observer is certain of their accuracy.
Remarks.

81

1881 m8

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure, graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods,

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

Bottle containing litmus or turmeric paper.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor 397.48+.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z
The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. Arctic

SPAR DECK.

BERTH

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.				
		Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.	Relative humidity.	Barometer.	Attached Thermometer.	Dry bulb.	Wet bulb.
1	30.00 59-26.1				29.95 55-26.1				29.97 59-25.6			14	12	78	15.5 11.7
2	29.94 49-24.4				29.97 49-24.4				30.00 58-23.8			12.5	11	82	14 12.8
3	30.03 53-24.4				30.02 58-23.3				30.10 52-21.6			10.5	8.5	75-12.	11.5
4	30.28 50-21.6				30.32 51-22.7				30.39 53-22.7			13	11	77	11.5 10.5
5	30.33 56-26.1				30.28 52-23.8				30.24 57-23.8			11.5	10	84.5	14.5 12.8
6	30.14 54-24.4				30.09 52-21.6				30.09 54-21.1			14	12	78	13 11.7
7	29.95 56-16.1				29.98 58-14.4				29.96 60-14.4			15.5	13.5	79	14 12.8
8	29.99 56-18.3				30.12 59-17.7				30.28 58-17.2			12	10	76	13 11.7
9	30.46 55-23.6				30.53 53.5-27.2				30.53 58.5-28.8			16	14	79	14 12.8
10	30.31 57-21.5				30.20 55-19.4				30.10 58-16.1			14	12.5	82.5	13.5 10.8
11	30.05 58-11.4				30.05 57-14.4				30.10 54.5-19.1			15.5	13.5	29	14.5 12.8
12	30.05 56.5-18.3				30.05 56-15.5				29.98 56-13.8			13.5	12	83	13.5 10.8
13	29.95 52-15.5				30.00 54-17.2				30.03 59-14.4			14	14	29	15 10.8
14	30.08 56-15.5				30.05 53-15.5				30.10 52.5-18.8			15.5	13.5	78	14.5 10.8
15	30.18 54-24.4				30.20 50-29.4				30.23 53-31.4			16.5	15	85	12.5 10.8
16	30.14 53-22.7				30.20 50.5-26.1				29.98 54-23.8			15.5	13	74	15.5 14.8
17	29.79 53-23.8				29.72 53-23.3				29.95 53-21.6			14.5	12.5	79	14 12.8
18	29.60 51-21.6				29.60 48-23.8				29.69 54.5-24.4			14.5	12	73	12.5 10.7
19	29.84 51-26.4				29.90 49-23.8				29.99 53-28.8			15	12.5	73	15 10.7
20	30.00 51-32.2				29.99 51-32.2				30.03 57-33.3			14	13	78	16.5 14.7
21	30.04 51-31.1				30.15 50-32.2				30.22 54.5-32.2			15.5	13	82	15 13.7
22	30.40 52-31.1				30.46 51-30.0				30.53 53-33.3			12.5	10.5	76.5	13 10.7
23	30.75 53-35.5				30.87 54-36.1				30.08 52.3-35.5			13.5	11.5	72.5	12.5 10.7
24	31.19 53-35.5				31.10 50-35.5				31.03 46-34.4			11	10	87	13 10.7
25	30.69 53-28.8				30.42 47-24.4				30.30 52-20.5			10.5	9	81	10.5 9.8
26	30.10 55-16.4				30.01 52-15.5				30.07 59-15.0			13.5	11	72	13.5 10.7
27	30.28 56-16.1				30.42 55-22.7				30.53 58-25.0			15.5	13	79	16 14.8
28	30.32 55-18.3				30.37 53.5-18.3				30.54 57-22.2			17	15	80	17.5 15.7
29	30.65 55-26.1				30.63 55.5-24.4				30.59 60-23.3			17	14	70	18 15.7
30	30.35 50-20.0				30.26 54-18.8				30.22 57-17.7			19	16	72	15.5 14.7
31	30.14 57-16.2				30.23 55-15.0				30.35 57-14.4			17	15	80	16 13.7
AVERAGE		30.19 54.1-23			30.23 55.4-26				30.19 53.9-23.1			14.6	12.7	78.5	14.5 12.7

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in the log. Same instruments to be used in all hygrometric observations.

Jeannette, for the month of January, 1881.

BERTH DECK.

AVERAGE NUMBER OF SHIP'S COMPANY.

REMARKS.

4 P. M.	10 P. M.	No.	WIND.	WEATHER.	Carbonic acid cor- rected for Temp. and Pressure, per 1,000 volumes.	Number of sick, ex- cluding injuries.	REMARKS.
Dry bulb.	Wet bulb.	Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.		
1881 13 79 14 12 78 NNE/NE	82	1	dry.				
14 12 78 12.5 11 82 ENE	6C	1					
12. 9 65-12.5 11 82 NNE	6C	1					
1881 10 81.5 105.9 85 87 NNE	6C	1.5953	1				
4.5 12 78 12.5 11 82 ENE	6C	1					
11 77 12 11 88 NW/W	6C	1					
4 12 78 18 12 88 ENE	OC	1					
3 11 77 13.5 12.5 88.5 NW/W	6C	1					
4 12 77 11.5 10.5 87.5 NNE/N	6C	1					
5 12 88 18 12 88 ENE	OC	1					
5 12 73 12 11 88 NNE	OC	2.4059	1				
5 12 83 12.5 11 82 ENE	OC	1					
5 13 78 15 14 88 NW/W	OC	1					
4.5 13 83 18 12 88 NW/W	OC	1					
5 13 88 13.5 12 83 NNE/N	6C	1	washed to deck				
5 14 86 14 12 78 NW	6C	1	dry.				
4 12 78 14.5 12.5 79 NW/W	OC	1.450	1				
5 10 71 11 10 87 NW/W	OC	1					
5 13 79 14.5 12 78 NNE	OC	1					
6.5 14.5 79 13 11 77 NNE	6C	1					
5 13 78 12.5 11.5 87.5 NW/W	6C	1					
3 11 79 11 10 87 NNE	OC	1	washed to deck.				
5 11 82 12 11 88 NW/W	6C	1	dry.				
11 88 11 10 87 NW/W	6C	1					
5 9 81 10 9 86 ENE	OC	1					
5 12 83 17.5 12.5 75-8 NNE	6C	1					
14.5 84 17.5 15.5 80 NW/W	6C	1					
5 15 75 15 13 78 N	OC	1					
15.5 75.5 16.5 13 79 N	6C	1	washed to deck				
5 14 84 14 12.5 83.5 NNE	OC	1					
13.5 74 12.5 11 82 N	OC	1					
12.5 78.4 13.1 11.9 83.4 16.2 N	6C 17 OC 12	1	washed on outside p.				

morning should be selected. The results will not be entered unless the observer is certain of their accuracy.
in column of Remarks.

Feb 1881.

19

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Lime water and distilled water.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following process, extracted from Wilson's Hand-Book of Hygiene, is recommended:

The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken so that the lime water is made to thoroughly-wash the contained air, and afterward is left to stand at least eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined. The difference is doubled to account for the 30 c. c. left in the jar, and the product gives the amount of lime which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748 +.

The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by 795 and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes. A correction must be made for temperature as it is above or below the standard of 62° Fahrenheit. As the coefficient of expansion of air is .0020361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62°.

The formula for the correction for pressure is as follows:

30 : observed height of bar. :: capacity : z.

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S. Arctic

BERT

SPAR DECK.

10 A. M.

4 P. M.

10 P. M.

10 A. M.

PLACE.

DATE.

Barometer.

Attached
Thermometer.

Dry bulb.

Wet bulb.

Relative humidity.

Barometer.

Attached
Thermometer.

Dry bulb.

Wet bulb.

Relative humidity.

Barometer.

Attached
Thermometer.

Dry bulb.

Wet bulb.

Relative humidity.

Dry bulb.

Relative humidity.

Dry bulb.

1	29.97 52-22.2	29.93 49.5-21.4	29.97 57-21.4	13.5 12.5 88.5 16.5
2	30.06 54-22.2	30.12 50-22.7	30.21 55-22.2	16.5 14 74 17
3	30.27 50-24.1	30.21 57-24.6	30.29 59-28.3	15.5 13 74 16.5
4	30.31 56-29.1	31.29 54-29.1	30.32 61-30.5	18 18-71 15.5
5	30.27 55-31.9	30.28 48.5-30.5	30.25 57-32.7	14 11.5 70 18 14 11
6	30.22 49-32.7	30.25 50 31.6	30.30 59-34.4	13 12 77 12.5 13.3 11
7	30.31 57.5-34.4	30.22 52-33.3	30.25 57-33.8	18 18 71 15 8.10
8	29.83 56-27.2	29.59 52-25.5	29.46 53-24.4	13.5 11 72 13.5 18.13
9	29.62 49-29.4	29.72 47-31.1	29.83 57-34.4	11 10 82 13 11 18
10	29.85 53-35.0	29.73 48.5-28.8	29.43 53-24.4	15.5 12 6.8 16 14 15
11	29.65 53-26.4	29.80 51-28.3	29.97 60-31.1	17.5 15 75-15 18 12
12	30.09 54-34.4	30.09 48-32.2	30.09 55.5-33.8	15.8 18 74 4.5 18 12
13	29.92 47-27.7	29.89 49-28.0	29.85 55-23.8	17.5 14.5 20.5 16.5 20 18
14	29.50 52-27.2	30.12 49-27.7	30.32 57-32.2	17 14 70 15.5 18.12
15	30.52 50-33.8	31.45 52-32.2	30.43 57.5-33.4	15 13 78 16 13.5 11
16	30.28 55-32.7	30.18 50-30.0	30.13 53-29.4	15 12 68 16 13.5 14
17	30.06 54-25.5	30.06 49-26.1	30.12 53-28.8	15 12 68 17 14.5 14.5
18	30.07 53-27.7	30.00 50-23.8	29.97 49-26.1	15.5 13 74 14.5 17.5 10
19	29.95 58-25.0	29.95 54-23.3	30.00 59-25.0	16.5 13 74 15.5 13.1 11
20	30.15 54-22.7	30.22 52-21.4	30.30 59-25.2	13 10 6.6 16 13.1 13
21	30.31 53-25.2	30.28 55-26.2	30.33 57-30.4	13 9 70 12.5 18 10
22	30.35 55-30.5	30.35 51-28.3	30.49 57-30.0	14.5 11.5 6.7.5 14 11
23	30.39 55-29.4	30.27 52-27.7	30.23 57-29.4	13.5 10.5 6.6.5 15.5 12.5 11
24	30.06 52-27.7	30.00 51-26.6	30.00 53-27.7	13 10 6.6 12 9.5
25	30.00 55-25.0	30.00 53-24.4	30.08 58-27.7	10 8 9.4 12 9.5
26	29.99 45-27.7	29.90 42-24.4	29.85 57-17.5	13 11 72 12 10.6
27	29.86 56-12.2	29.89 50-17.2	30.10 63-26.1	15.5 13.5 7.9 14 11.7
28	30.30 57-23.8	30.38 58-21.6	30.48 57-23.8	14 13 8.9 13.5
29	30.34 52-21.6	30.23 52-18.3	30.18 58-20.0	13 11 77 14.5 14.5
30	30.20 53-18.3	30.20 53-19.4	30.25 58-23.3	15 12.5 7.8 15.5 14.4
31	30.28 56-24.4	30.29 54-22.2	30.35 57-26.1	12 10 7.6 14 14.7
AVERAGE	30.09 53.3-27.1	30.12 51-28.9	30.12 56.5-27.6	14.8 12 7.9 14.4 11.9 10.5

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the morning. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in column 5. Same instruments to be used in all hygrometric observations.

H. Grannette

, for the month of March, 1882.

BERTE DECK.

AVERAGE NUMBER OF SHIP'S COMPANY.

REMARKS.

4 P. M.	10 P. M.	No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.	REMARKS.
Dry bulb.	Wet bulb.	Relative humidity.					
Dry bulb.	Wet bulb.	Relative humidity.					
16 76.5 135.6 95.5 15.5 14	84	22 W	0 C		1		
17 14 70 16 14 79	22 W	6 C			1		
16.5 14 74 16 14 79	22 W	6 C			1		
15.5 12 64 17 15.5 15	22 W	0 C	4.8479	1			Dom in fore with had been closed up to 10 p.m.
13 11 77 14 11 67	22 W	6 C			1		Bath deck worked up.
12.5 10.5 76.5 13 11 22	W	6 C			1		
15 12 68 10 85 80	W W W	6 C			1		
13.5 10.5 66.5 13 10 66	0 W	0 C 9			1		
13 10 66 13 11 72	W W W	6 C			1		
16 12 56.4 15 13 78	W W W	6 C			1		
5 12 68 12 10 76	W	6 C	1.32408	1			CO ₂ Taken at 10 p.m. Bath deck.
15 12 68 12 10 76	W W W	6 C			1		
16.5 13.5 70 18 15 21	12/1	0 C			1		
5.5 12.5 68.5 12.5 10.5 76.5	W W	6 C			1		
6 13.5 75 17.5 9.5 75.5	12	6 C			1		
6 13 69 14 12 68	12	6 C			1		
7 14 70 14.5 12.5 78	0/2	0 C 1/2			1		
5 11.5 67.5 10 9 97	202	6 C	1.9266	1			
5.5 13 74 14 12 68	202	6 C			1		Bath deck worked up.
6 13 69 13.5 10.5 66.5	0 2	6 C			1		
25 10 71 10.5 85 25	202	6 C			1		
4 11 67 11.5 9.5 75.7	2	6 C			1		
5 12 68 13.5 11 72	202	6 C			1		
2 9 65 9 7 73	202	6 C			1		
9.5 75.5 12.5 9.5 65.5	202	6 C			1		
10 76 11.5 10.5 81.5	202	6 C			1		
11 67 13 11.5 82.5	202	0 C 0			1		
5 11 72 12 10.5 82	0	6 C			1		
5 12 78 10 8 74	202	6 C			1		
5 14 84 13 11 77	2	6 C			1		
6 13 79 12 10 76	202	6 C			1		
6 11.5 70.5 10.5 11 79	7	6 C 20 0 C 1/2 0 C 2	2.7714	1			Bath deck worked up on entire top

The results will not be entered unless the observer is certain of their accuracy.

Remarks.

20

March 1881

For ascertaining the amount of carbonic acid in the air the following apparatus is supplied:

Two glass jars, cubic capacity marked in cubic centimeters.

India-rubber stoppers, and sheet india rubber to tie over necks of jars.

Glass measure graduated to 60 c. c.

One Mohr's burette, 60 c. c., graduated into tenths.

Glass rods.

Glass bottle of one liter capacity.

Bottle containing papers of crystallized oxalic acid of 2.25 grammes each.

A small bellows, or, in its absence, a Davidson's syringe may be used.

Directions: Pettenkofer's method is to be followed. For those not familiar with it the following

process, extracted from Wilson's Hand-Book of Hygiene, is recommended:
The analysis depends on the relative alkalinity of lime water before and after it has absorbed the carbonic acid in the sample of air examined. 2.25 grammes of crystallized oxalic acid are dissolved in 1 liter of distilled water; 1 c. c. of this solution exactly neutralizes 1 milligramme of lime, and hence the amount of lime in a given quantity of lime water can be determined by adding the solution of oxalic acid until the point of neutralization is reached. The amount of oxalic acid required for neutralization expresses the alkalinity of the lime water. If the alkalinity of the lime water be known before and after it has absorbed the carbonic acid in the air contained in the glass jar, the difference will give the amount of lime in milligrammes which has united with the carbonic acid, and the amount of the latter is obtained by calculating according to the atomic-weights.

The jar should be perfectly clean and dry. The air to be examined is forced into the jar by a pair of bellows, or a bellows-pump may be used. In either case the nozzle should reach the bottom of the jar.

After the jar has been filled, 60 c. c. of lime water are introduced, the mouth of the jar closed by the stopper, and the stopper secured by a tightly-fitting india-rubber cap. The jar is then well shaken by eight hours and not more than twenty-four; 60 c. c. are introduced in order that 30 may be taken out for analysis.

Thirty cubic centimeters of lime are poured into the graduated glass and its alkalinity determined by the test solution. Then 30 c. c. are taken from the jar and the alkalinity also determined, which has combined with the carbonic acid. The amount of the latter is obtained by converting weight into volume according to the atomic weights, and in one sum by the factor .39748+. The following rule will simplify the calculation: Multiply the difference between the alkalinity of the lime water before and after it has been placed in the jar by $\frac{755}{755}$ and divide this sum by the number of cubic centimeters in the jar, minus 60. The result will be the ratio of carbonic acid per 1,000 volumes.

As the coefficient of expansion of air is .0029361 for every degree of Fahrenheit, the rule for correction may be stated with sufficient accuracy thus: For every 5° Fahrenheit, above 62° add 1 per cent. to the amount of carbonic acid calculated as above, and deduct the same percentage for every 5° below 62° .

The formula for the correction for pressure is as follows:

$30 : \text{observed height of bar.} : : \text{capacity} : z.$

The result expressed by z is substituted for the actual capacity of the jar in the calculation for carbonic acid.

Atmospheric Observations on board U. S. S

SPAR DECK.

BERT

PLACE.	DATE.	10 A. M.			4 P. M.			10 P. M.			10 A. M.		
		Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.	Barometer.	Attached Thermometer.	Dry bulb.
1													
1879													
24	29.80 38.4-2.1	29.87	74.2-2.9		29.86	38.6-2.1		29.8	10.4 72.4 18.7				
25	29.66 32 -11.1	29.65	82 -11.4		29.68	82 -11.5		29.6	9.5 71.3 10.1				
26	29.70 32 -19.9	29.73	72 -17.2		29.75	92 -17.2		29.7	14.4 12.1 74 14.3				
27	30.11 32 -23.6	29.98	32 -23.8		29.97	32 -23.5		29.9	14.1 12.5 88.5 14.1				
28	30.32 32 -33.7	30.23	82 -33.7		30.31	82 -34.4		30.3	15.6 14.1 82.1 15.2				
29	29.97 32 -38.8	29.92	32 -38.7		29.88	32 -38.9		29.8	11.4 10.8 89.8 12.1				
30	30.03 32 -28.1	30.01	32 -27.7		30.04	32 -31.4		30.0	15.3 14 86 10.6				
31	29.80 32 -13.9	29.79	32 -12.1		29.83	32 -16.2		29.8	11.2 10.4 85.9 15.8				
Aug	29.97 32 -8.4	29.98	32 -7.7		30.00	32 -10.6		29.9	9.9 8.9 83 10.6				
1880	39.78 35.6-25.4.03	39.78	39.5-24.1.8	88	29.78	32.8-5-18	92.8-8.7	8.1 92.2 10.2 14.11.6					
July	29.65 37.4 2 1.5 92.8 28.44 40.1 4.5-3.4 80.9 29.63 85-1	29.65	37.4 2 1.5 92.8 28.44 40.1 4.5-3.4 80.9 29.63 85-1	0.7	90.1 8.9 8.5 94.1 9.6	93 11.7							
Aug	29.79 38 1.3 1.1 95.5-29.84 37.4 1.6 1.4 94 29.84 34.8 0.3 0.06 98	29.79	38 1.3 1.1 95.5-29.84 37.4 1.6 1.4 94 29.84 34.8 0.3 0.06 98	8.6	8.6 8.2 97.2 10.9 14.6	11.1							
Sept	29.76 49.4-4.7	29.80	48.7-4.6		29.82	51.5-6.4		29.8	8.4 7.7 90.4 11.6 11.9 12.				
Oct	30.23 51.2-15	30.22	50 -14.5		30.24	53.7-15.3		30.2	7.7 5.9 78.7 11.7 12 11.9				
Nov	30.10 52 -21.5	30.06	50.9-21.9		30.07	53-21.7		30.0	12.7 10.6 76.5 12.2 11.1 12.5				
Dec	29.97 53.7-24.7	29.93	53.3-24.6		29.97	55.7-24.4		29.9	12.2 10.7 74.5-13.2 11.5 12.1				
Jan	30.19 54.1-23	30.23	55.4-26		30.19	53.9-23.1		30.1	14.6 12.7 78.5 14.5 12.4 13.1				
Feb	30.01 55 -21.7	30.38	53.7-28.4		30.38	58 -22.4		30.3	13.9 11.6 74.9 13.9 11.8 13.8				
March	30.09 53.5-27.1	30.12	51 -25.9		30.12	56.5-27.6		30.1	14.5 12 73 14.6 11.7 12.9				
Apr	31.15 -53 17	30.00	51 -16		30.18	54.8-16.8		30.1	71 6.1 79.8 19.3 11.1 9.9				
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													

AVERAGE

Observations for carbonic acid should be made at least once a week, and the air of the berth deck at night or early in the m. The time and circumstances of observations for carbonic acid and the wetting of the decks from any cause will be entered in. Same instruments to be used in all hygrometric observations.

AVERAGE NUMBER OF SHIP'S COMPANY.

REMARKS.

Relative humidity.	Dry bulb.	Wet bulb.	Relative humidity.	10 P. M.	No.	WIND.	WEATHER.	Carbonic acid corrected for Temp. and Pressure, per 1,000 volumes.	Number of sick, excluding injuries.	REMARKS.
11.70	13.9	11.6	78.1		OC 16			8.6206	0	Span deck with from melting ammonia
11.72.3	14.3	11.6	69.5		OC 16					
11.274.7	15.6	13.3	75.6	N	OC 7			1.47	0	
11.684.8	15.3	13.7	83.6		OC 5					
11.689.3	15.8	14	81		OC 24			1.711	0	
11.386.3	13	12	88		OC 17			2.578.4		
11.4284.7	15.8	14.5	86		OC 14			0.975.6	0.2	84 Telling in Deck house, clamps.
11.384.5	16.7	14.2	80.2		OC 24			2.854	1	
11.84.3	10.6	12	92	A	OC 19					
11.9894	11.6	11.1	93.3	W	OC 15			1.561	1	Decks washed up twice a week.
11.393	11.7	11.2	94.3	A	OC 15			2.4218	1	17 days dry. 13 wet melting snow + Rain
11.9496	11.6	11.2	94.5	N	OC 13			2.637	1	R 5°, decks washed 5°. 1.6. (A. small)
11.988.9	12.5	11.4	91.2		OC 28			1.8756	1	R 5° .. 4 .. 6°
11.882	11.9	10.2	79	W	OC 3			OC 19		
11.77.1	12.5	10.8	79.1	72	OC 11			2.579	1	R. 1. .. 2 .. 8. R + 5 2.
11.276.5	12.1	10	82.1		OC 15			OC 16		
11.278.4	13.1	11.9	83.4		OC 16			1.9921	1	
11.876.8	13.8	12.2	81.3		OC 6					
11.970.5	12.9	11	79	V	OC 24			1.8069		
11.678.5	9.9	8.7	80	V	OC 8			1.884.4	1	Decks washed 1. a week, 1. 2
					OC 23			2.3913	1	
					OC 14			8		
					OC 17			1.0730	1	
					OC 9					
					OC 24			2.0803	1	
					OC 25					
					OC 2			2.7714	1	
					OC 15					
					OC 9			1.2078	1	
					OC 4					

should be selected. The results will not be entered unless the observer is certain of their accuracy.
in column of Remarks.



